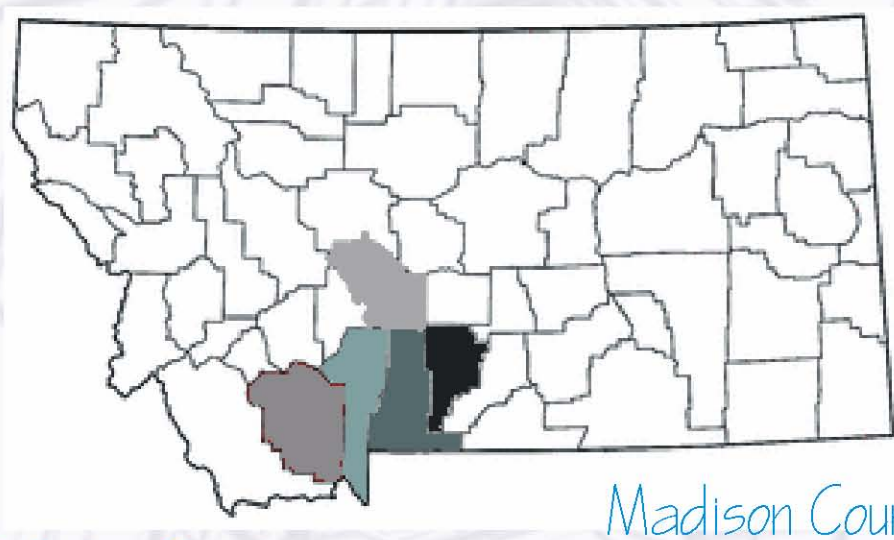
CTA COMMUNICATIONS, Inc.

CONSULTANTS

INTEROPERABLE COMMUNICATIONS PLAN



Madison County

Gallatin County

Meagher County

Park County

Sweet Grass County

South Central Montana Interoperability Consortium

August 29, 2005

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EXECUTIVE SUMMARY

The South Central Montana Interoperability Consortium (SCMIC) consists of Sweet Grass, Park, Meagher, Madison, and Gallatin counties. The southern Montana area is diverse and growing, and is characterized by long-held traditional values coupled with dynamic growth and technological progress. The public safety agencies serving the five counties are faced with multiple technical, operational, and financial challenges.

The five counties signed a Letter of Intent to address the problems that must be overcome to have a reliable, effective communications system capable of providing interoperable wireless voice and data exchange; as well as alerting. In addition, the Consortium entered into a Memorandum of Understanding with the State of Montana Department of Military Affairs, Disaster and Emergency Services Division. The objective of that agreement is to assess the radio communications needs, capabilities and vulnerabilities of the members, both collectively and individually, then develop a comprehensive communications plan aimed at achieving a reliable, effective and fully interoperable communications system within the counties themselves and also between all local, state, and federal entities that may be involved in emergency management and response.

CTA Communications of Lynchburg, Virginia was selected to perform a user driven needs assessment. CTA performed multiple tasks in creating this assessment. Some of the tasks were:

- Developed project work plans
- Reviewed existing system data
- Conducted an initialization meeting
- Conducted facility survey and interviews
- Completed radio traffic analysis
- Analyzed radio coverage
- Completed a vulnerability assessment
- Developed system attributes
- Developed site facilities' requirements
- Analyzed alternatives
- Conducted an impact analysis
- Provided an initial opinion of probable cost analysis
- Developed a conceptual system design
- Developed detailed opinion of probable cost analysis
- Developed transition plan

- Completed a draft report

CTA is now providing this final report; and providing a formal presentation.

CTA Communications conducted over 63 interviews with various agencies and individuals. These interviews, along with written survey responses, provided us with an understanding of the current and desired operational environment, these are in APPENDIX B. In addition, CTA conducted 26 site surveys and dispatch center surveys, which provided us with an understanding of the current communications equipment environment, these are in APPENDIX C.

The agencies and communities within your region have developed over the years a strong mutual aid and interoperability ethic. Your agencies realize they often depend on each other. Your personnel's strong interoperable mindset is only limited by your technologies. Fortunately your radios are generally in the same frequency band - VHF- allowing the users to share frequencies. This sharing provides for a large degree of interoperability among neighboring communities. Within each county, a good degree of agency interoperability and cooperation already exists. This is achieved primarily through use of the common VHF frequency band, and the sharing of channels.

Some of your counties and agencies are in very good condition but all have room for improvement. CTA examined the counties' existing two-way radio and fire alerting/paging systems. Following is a summary statement of the problems, deficiencies, and concerns as either expressed to CTA in interviews and written surveys or observed by CTA during our site surveys.

Problem Assessment Summary:

We note that there were substantial variations in the level of communications infrastructure and capabilities among the counties. While we found all of these conditions in some counties, we found in others that only one or two were evident. In the Study Report, we described each county's specific situation. In this Executive Summary, we describe the region collectively.

While there were a number of unique problems encountered in each county, there were also a number of problems that were common to all of the counties. They are summarized below:

<u>Lack of Coverage</u>

Complaints about dead spots and poor voice coverage areas are common throughout the Region. Radio contact is sometimes lost when operating with either portables or mobiles.

Often these poor coverage areas are also areas where incidents frequently occur and that sometimes require a complex public safety response.

Inefficient Design

Many county systems consist of multiple repeaters distributed throughout the county, using the same frequencies but separated by different squelch tones and codes. Users must manually switch channels to access the repeater that provides coverage in their geographic area. This creates operational challenges for the field user, since they must proactively change channels as they move through the county. It also creates challenges for the dispatchers, who must also know where the field user is located at all times in order to select the proper repeater for communications. For a dispatcher who must monitor multiple channels, this process sometimes causes missed transmissions.

Transmitter Sites Inadequate.

Many of the site facilities are inadequate. Public safety communications systems must reliably function under all conditions. We observed problems with power, backup power, HVAC, site security, grounding, and lightning and surge protection. We also observed equipment buildings that were cramped, and would not support future expansion.

Aged Non-Fixed Equipment

A number of the agencies in the counties are using inexpensive radio equipment that generally would not be considered "public safety grade". When these radios are exposed to the kind of demands placed on them by public safety agencies, they often do not provide public safety service. They typically lack public safety radio features. Since they frequently transmit at lower power levels than typical public safety radios, their range is reduced, which further increases coverage problems. Some of the equipment was originally obtained used, and is no longer supported by the manufacturer. This means that repair parts are frequently no longer available. Much of the older equipment is not capable of meeting FCC mandated narrowband requirements.

Lack of Back-Up Communications between the Dispatch Centers

At present there exist only telephone line connections between dispatch centers. This prevents certain interoperability functions and makes little allowance for dispatch center back-up provisions. Lack of broadband interconnection keeps dispatch centers from being able to share data and files.

Fire Alerting/Pager System Limitations

Dispatchers must manually switch between repeaters to obtain coverage in the geographic area of concern. Since the dispatcher must make an educated guess of the location of the individual being paged, some individuals fail to receive the call. The paging systems have little or no redundancy. There are areas in the counties where pager coverage is limited.

FCC and State Mandates

CTA also considered the future regulatory issues mandated by the FCC and initiatives issued by the State. Under their “Refarming” order, current radio systems in the 150 to 500 MHz bands will be required to be replaced with newer, more spectrally efficient equipment that uses less bandwidth.

The Federal Communications has imposed a requirement on all radio users in the frequency bands currently being used in the South Central Montana Interoperability Consortium that all operations move to narrowband operation by January 1, 2013. In addition, Congress mandated that all federal government operations be narrowband capable by January 1, 2005. The U.S Forest Service, the Bureau of Land Management, the National Park Service are all in the process of migrating to narrowband operation at the present time. Once that migration is complete, communications with these agencies will be difficult on the federal channels.

The Montana State Interoperability Executive Council (SIEC) has adopted the following technical requirement that must be met for systems to be eligible for funding through the SIEC and the Montana Division of Emergency Services:

Through the deployment of a migration plan that identifies the steps and process for each participating agency, the system will combine P25 trunked and P25 digital / analog conventional technologies to provide interoperable communications among P25 narrowband digital trunked and existing conventional users. All equipment must be compatible and seamlessly integrate with infrastructure equipment deployed in CDP 1 - Southwest Interoperability Project and CDP2 - Northern Tier Interoperability Project.

While the older radio equipment is “grandfathered” until after 2011, the SCMIC counties will need to consider this mandate in their future operations. Much of the existing non-fixed radio equipments and some of the transmission infrastructure is not narrowband compliant at this time.

These major deficiencies plus a number of other operational and technical concerns inhibit the region's public safety agencies from interoperating at full capacity and efficiency; and threaten to move to an even lager operational gap in the future. Mutual aid and assistance to and from neighboring jurisdictions routinely occur with limited ability to communicate by radio with the public safety personnel of those jurisdictions. This situation is inefficient at best.

Based on the over sixty interviews conducted during the Needs Assessment, CTA developed a high level design for an interoperable multimode radio communications environment for the five county area based on federal and state communication standards in which federal, state and local public safety and emergency management representatives can operate autonomously and transition seamlessly while communicating effectively in emergency mission roles as well as in other appropriate administrative and command and control roles. The system design addressed the following elements:

- Improved Coverage
- Interoperability
- Non-Fixed or Subscriber Equipment
- Interconnectivity
- Paging and Alerting
- Dispatch Consoles
- Mobile Data
- Encryption
- Maintenance and Support

As part of the system design, CTA also developed a five phase transition or implementation plan. Following is an overview of the five phases and a summary of what will be accomplished during the phase:

- Immediate (As soon as possible) – Critical site improvements (back up power and grounding) will be accomplished at needed sites and purchasing new portable radios assuring that each department has at least some narrowband capability.

- Near Term (12-24 months) - The major goals of this phase to improve coverage in each county, to fill the unmet needs for subscriber equipment, and replace older non narrowband capable radios still in use.

- Mid Term (2-5 years) – Complete the upgrading of all subscriber equipment to P25 capable units that are currently in the agencies' fleet of radios; and install an interconnectivity/microwave network.

- Long Term (5-10 years) - Based on a seven to ten year useful non-fixed equipment life span, all non-fixed equipment will be replaced during this phase. At this time, trunking capable units will be acquired in preparation for the future phase and for interconnection with other State imitative. In addition, independent mobile data systems will be implemented to expand the functionality and available applications. Interoperability with the statewide network will be maintained.

- Far Term (10-20 years): Migration to the statewide trunking system will be completed in those areas where indicated based on operational needs.

The goal throughout all phases is to improve operations and preparations for future phases. Special attention is given to fiscal responsibility. The purchase of equipment that will not be of use in the future is reduced to essentially none (see SECTION 10). The succeeding phases build on each other in a logical fashion, each term providing the foundation and allowing for the progress to the next higher phase. At no time in the process will existing operations be reduced or made more complex. No harm is done anywhere in the process. Also of importance is the fact that if the process is stopped at any term or phase, the remaining system continues to provide service.

As you are aware, the state of public safety communications in your counties will have a direct impact on the quality of life in your communities. Your citizens deserve the very best of service that you can provide. In this Study we have placed a great emphasis on realistic and conscientious spending. Our recommendations reflect not a "pie in the sky" system, but a good serviceable communications network that will serve you now and in the future.

The SCMIC agencies and their personnel have expended a great deal of effort in assisting CTA in creating this Study. From our perspective it has been an enjoyable and satisfying experience. It is important that this effort be for good effect for the participants. We ask that all concerned parties carefully review the parts of the Study Report that pertains to them or their County, and also review the parts that describe the regional (SCMIC) aspects of the project. From a position of knowledge you will then be able to take the next steps: decide on and initiate your course of action

It has been our privilege to work with the South Central Montana Interoperability Consortium and the public safety agencies of the five county region. We were impressed by the sincerity and dedication of the people with whom we worked.

We note that many of the concerns we expressed early on about the site conditions and other issues are already being addressed. We commend all of the agencies for that. We were impressed as well by the ingenuity displayed by the agencies and personnel to try to solve some of the problems on a very limited budget.

In addition to this Report, CTA Communications was contracted to provide an equipment based Request for Proposals based on performance measurements to acquire future system components. This is being completed outside of this document. CTA performed the following tasks in developing the specifications: finalized the design; developed system specifications; defined site facilities requirements; provided system pricing forms; assisted in developing evaluation criteria; provided draft specifications; and provided final specifications.

1.0 INTRODUCTION

The South Central Montana Interoperability Consortium (SCMIC) consists of Gallatin, Park, Madison, Sweet Grass and Meagher Counties. The area is a diverse and growing area. This region is characterized by long-held traditional values coupled with dynamic growth and technological progress. The public safety agencies serving the five counties are faced with multiple technical, operational, and financial challenges.

The five counties signed a Letter of Intent to address the problems that must be overcome to have a reliable, effective communications system capable of providing interoperable wireless voice and data exchange as well as alerting for the entire spectrum. In addition, the Consortium entered into a Memorandum of Understanding with the State of Montana Department of Military Affairs, Disaster and Emergency Services Division. The objective of that agreement is to assess the radio communications needs, capabilities and vulnerabilities of the members, both collectively and individually, then develop a comprehensive communications plan aimed at achieving a reliable, effective and fully interoperable communications system within the counties themselves and also between all local, state, and federal entities that may be involved in emergency management and response. [1]

CTA Communications was selected by the SCMIC to perform an End User Driven Needs Assessment and Analysis and to develop a Request for Proposal and Specifications to implement the systems designed as a result of the Needs Assessment. This report presents the results of CTA Communications comprehensive needs analysis. The report is a result of CTA Communications having visited, interviewed, surveyed sites, and followed up with virtually all of the public safety agencies in the five county area. CTA then studied the resulting data and has applied best communications practices in recommending, jointly and county by county, an interoperability and acquisition plan.

We wish to thank all of the agencies which participated in this study for their cooperation and support. It was obvious from the knowledge and enthusiasm of the individuals with whom we met and interviewed that they are all cognizant of the importance of working together to solve their joint communications problems. Each agency and department provided us with open access to both their personnel and their facilities. We especially wish to express our thanks and appreciation to the SCMIC representatives for both the professional manner in which they organized our meetings and interviews and the friendly and efficient way in which they responded to our needs in preparing this report.

SECTION 2 of this report covers the Current Communications Environment. SECTION 3 discusses the current communications problems, concerns and needs. SECTION 4 describes the functional attributes that a public safety communications system should have. SECTION 5 analyses alternative designs. SECTION 6 reviews the regulatory issues affecting public safety communications systems. SECTION 7 presents CTA's Interoperability Design. SECTION 8 outlines system support issues. Facility and site requirements are presented in SECTION 9. CTA's cost estimates are contained in SECTION 10. Our conclusions and recommendations are in SECTION 11.

[1] Memorandum of Understanding between Montana DES and South Central Montana Interoperability Consortium.

2.0 CURRENT COMMUNICATIONS ENVIRONMENT

This section defines the current radio systems and dispatch operations as it exists in each of the five counties participating in the South Central Montana Interoperability Consortium. Present radio channel allocations are also discussed as is the number of non-fixed (mobile and portable) radios currently in use with a fifteen year projection of the radios needed in the future.

2.1 Current User Environment

With the exception of three agencies (City of Bozeman Sanitation and Parks Divisions and Yellowstone Club), all agencies in the five county area currently use radio channels in the VHF high-band portion of the spectrum. TABLE 2-1 provides a listing of the current frequencies used by local government agencies in the five county area. The State of Montana has developed a well-defined MUTUAL AID and COMMON FREQUENCIES PLAN. The nineteen frequencies included in that plan are included in TABLE 2-1.

The user agencies have a wide mix of mobile and portable radios. In addition, some of the agencies are just beginning to use mobile data computers. TABLE 2-2 summarizes the quantities of user equipment currently in service in the area.

The public safety and public service agencies in the five counties depend heavily on radio to conduct day-to-day operations. With the large distances involved in each of the counties increases the need for effective communications systems. The following is an overview of how radio is used in each of the counties.

2.1.1 Gallatin County

There are seven law enforcement agencies, fifteen fire departments, and two emergency medical service providers (ambulances) in Gallatin County. In addition, the City of Bozeman has a public works department, and there is the Gallatin County Road Department.

There are three primary dispatch centers in the County. The Gallatin County/Bozeman 9-1-1 Center serves most of the county. The West Yellowstone Police Department serves the far southern end of Gallatin County. The Montana State University Police Department covers the MSU campus in Bozeman. Gallatin County and the City of Bozeman have experienced significant population growth, especially over the past decade. Projections provided by the City Planning Department anticipate that the population of Gallatin County will increase by forty-two percent over the next twenty years. The area in and around Bozeman will continue to be the major commercial and population center of the five county area.

The Big Sky area is a unique situation with part of the area located in Gallatin County and part of the area located in Madison County. There is no effective communication between Madison County and the portions of the Big Sky area in Madison County and only limited communications between that area and Gallatin County. A separate study of that area was conducted as part of the development of the Big Sky Joint Operations Plan.

2.1.2 Gallatin County Law Enforcement

Gallatin County law enforcement agencies use four primary dispatch channels. One channel is used by the Bozeman Police Department. The second channel is used by the West Yellowstone Police Department; the third is used by the Gallatin County Sheriff, the Belgrade Police Department, the Three Forks Marshall, and the Manhattan Police Department. The Sheriff's Office has a secondary dispatch channel that is used to communicate with units in the Gallatin Canyon. Montana State University uses its own dedicated channel. Most of the departments have their own tactical channels.

The Montana Highway Patrol is currently building out a statewide mobile data system. The first phase was installed in 5 counties (Lewis & Clark, Gallatin, Cascade, Yellowstone, and Silver Bow). Both the Bozeman PD and the Gallatin County Sheriff are participating in the startup of the project. The Motorola DataTac mobile data system uses a dedicated UHF channel. The system is about one year old. The Bozeman Police Department has thirteen installed laptops, the Sheriff's Office has eight, and Belgrade Police has four. Currently the system runs tags and person queries from the Criminal Justice Information Network (CJIN) and does limited queries from the RMS system.

CAD dispatch and field reporting functions are planned. The system will be expanded by the State later this year. Most of the non-fixed equipment (mobile and portable radios) have sufficient channels so that the appropriate mutual aid and common frequencies are included. Many of the newer radios are narrow-band capable.

Gallatin County owns and operates a multiple site alpha-numeric paging system. There are eight sites on the same frequency currently being used for paging of police and fire personnel. Currently, there are 457 pagers on the system. Paging is one-way only at this time.

2.1.3 Gallatin County Fire Departments

Gallatin County fire departments use three channels for dispatch. The City of Bozeman Fire Department operates on its own channel as does the West Yellowstone Fire Department. All the remaining fire departments use the countywide dispatch channel, designated as “Fire North”. Initial dispatch of calls is by means of the county-owned alpha-numeric paging system.

The Gallatin County Fire Council, consisting of all of the fire departments in the County, maintains three tactical repeaters (Fire West, East and Central). Each of the tactical fire repeaters operate on a different pair of frequencies.

Emergency Medical Transport Service is provided by four agencies in the County. Bozeman Fire/Rescue provides advanced life support service within the City of Bozeman. Three Forks Ambulance and West Yellowstone Fire provide service in their respective areas. American Medical Response (AMR) provides service in the remaining part of Gallatin County. AMR operates its own dispatch center. The other EMS operations use the fire channels for dispatch communications.

At the present time, none of the fire departments or emergency medical service providers has mobile data computers.

2.1.4 Gallatin County Dispatch Centers

The Gallatin County/City of Bozeman 911 Center is located in the basement of the joint Law and Justice Center. It is staffed by fifteen full-time dispatchers, three supervisors, an Executive Assistant and a Director.

The supervisors are “working” supervisors, meaning that they are expected to both work a position in the dispatch center and provide supervision in the center at the same time. In addition to the communications center responsibility, the department also is responsible for support services and records division which provides records management for the Bozeman Police Department, the Gallatin County Sheriff’s Office and the Gallatin County Detention Center.

The department is governed by a seven member administrative board consisting of four representatives from the City of Bozeman and three representatives from Gallatin County. The current board members include the Bozeman City Manager, the Bozeman Director of Public Safety, the Bozeman Fire Chief, the Bozeman City Attorney, the Sheriff, a County Commissioner, and a Deputy County Attorney.

The agency provides 911 and dispatch service for most of Gallatin County and the cities within it. In addition, the center serves the Big Sky and Yellowstone Club portions of Madison County that are only accessible by roads from Gallatin County. In 2004, the center dispatched 63,930 police incidents, 3,931 fire calls, and 3,001 medical calls. The center provides Wireline Enhanced 911 and Phase I Wireless 911 service. They are currently using an Intergraph CAD system (version 7.7.6) that is approximately four years old. The CAD system is interfaced with the 911 system, the records management system, state criminal justice information system, and the mobile data system. The agency has installed a CML Rescue Star 911 system. That system is fully wireless Phase I and II compatible. They are in the process of integrating a GIS/Mapping system. Orbacom LED consoles are in use.

Typical staffing is two dispatchers and a working supervisor. Each of the four positions in the center is capable of operating on all channels. As noted above, five primary dispatch channels are in use (three police and two fire). In addition, the center has access to a number of mutual aid and other channels.

The county owned alpha-numeric paging system is used to alert the fire departments and EMS responders of calls. It is used to contact other public safety personnel as well. The paging system has redundant Zetron model 2200 paging terminals.

The West Yellowstone Police Department provides 911 and dispatch service for the far southern portion of Gallatin County. The dispatch center is located in the police department. West Yellowstone contains the west entrance to Yellowstone National Park. During the winter months (October – April), the west entrance is closed to wheeled vehicular traffic. Only snowmobiles and similar tracked vehicles are allowed to enter via the west entrance during this time. During the summer months (May-September), a significant portion of the over 2.5 million visitors to Yellowstone National Park Use the west entrance.

The West Yellowstone Dispatch Center is a two-position center. Normal staffing is one dispatcher per shift. When staffing permits, a second dispatcher is assigned on the afternoon shift. In addition to dispatching the West Yellowstone Police, Fire, EMS, and Public Works Departments, the center also provides service to the Montana Highway Patrol and Gallatin County Sheriff's Office units, when they are in the area and unable to contact their normal dispatch center. They also support Yellowstone National Park rangers working the far western portion of the park as well as other state and federal agencies in the area.

The center provides Basic 911 service and Wireless Phase 0 service. They Use a Motorola Centralink 911 system. The radio consoles are Motorola Centracom Elite. The agency currently does not have a computer aided dispatch system.

The third dispatch center in Gallatin County is the Montana State University (MSU) Police Department. The MSU Police Department provides all law enforcement on the MSU campus in Bozeman. Fire and rescue services are provided by the Bozeman Fire/Rescue Department. The MSU Dispatch Center functions as a secondary PSAP on the Gallatin County 911 system. 911 calls from campus are answered by the Gallatin County PSAP and then transferred to the MSU Police if appropriate. The department has a four-digit campus extension (2121) for people on campus to call to department direct. The dispatch center has a single operating position. One person is on duty at any one time around the clock.

2.1.5 Other Agencies

The City of Bozeman Public Service Department has 3 divisions that use radios: Water and Sewer; Streets and Sanitation, and Parks. The Water Department or Division and the Streets Division Use a VHF High-band channel.

The Sanitation and Parks Divisions use a UHF channel. Both channels have repeaters. Neither of the channels is monitored by the 911/dispatch center.

The Water Department has access to water line locations using tablet computers. These computers are not connected to the radio system.

The Gallatin County Health Department provides services countywide. The services the Health Department provides generally are in the areas of Environmental Health, Human Services (immunizations) and Infection Control services. The Health Department does not currently have communications equipment on the public safety systems.

Bozeman Deaconess Hospital is the primary medical care facility in the area. It is a Level II Trauma Center and serves as the regional trauma center. The next closest Level II centers are in Butte and Billings. The hospital has its own paging and radio system. The radio system is used by the hospital maintenance and security staffs. They have a control station in the Emergency Room that can access the public safety channels

The Gallatin County Road & Bridge Department is responsible for the maintenance of 243 county maintained roads totaling over 800 centerline miles, 205 bridges, including those within Bozeman city limits, and approximately 5000 culverts. The department employs 34 people including equipment operators, mechanics, and administration. The department operates a single site repeater system on its own channel.

2.2 Park County

There are two law enforcement agencies, eight fire departments, and three EMS transport agencies in Park County. In addition, the City of Livingston has public works department and there is the County Road Department.

There are two primary dispatch centers that serve the county. The Park County/Livingston Dispatch Center serves most of the county. The Yellowstone National Park Dispatch Center in Mammoth Hot Springs, WY serves the far southern end of Park County including Gardiner and Cooke City.

Park County contains two of the entrances to Yellowstone National Park. During the winter (October – April), the North entrance is the only access to the park that is open to wheeled vehicles. Both the North and Northeast entrances to Yellowstone National Park are in Park County. Approximately 750,000 of the 2,900,000 visitors to the park each year use one of those entrances. Currently, during the winter, the only way to get to Cooke City by wheeled vehicle is by entering the park at the north entrance (Gardiner) and then driving approximately 52 miles through the park and exiting the park at the northeast entrance. Currently, the Colter Pass is not plowed. There is discussion about keeping the pass open during the winter beginning in the next several years. This will result in increased traffic in the winter. During the peak summer season, all of the available lodging, recreational vehicle, and camping spots in the park fill up every day. Much of the overflow comes into Park County and creates traffic problems.

Significant residential development is expected in Park County, especially in the Livingston area. It is anticipated that the City of Livingston's population will increase by more than fifty percent over the next several years. Similar growth is expected in the county as well.

2.2.1 Park County Law Enforcement

The Livingston Police Department provides primary law enforcement service for the City of Livingston. The Park County Sheriff's Office provides primary law enforcement service for Park County. The Montana Highway Patrol has approximately 200 troopers statewide. They have limited authority. They are primarily traffic patrol. Because there are only about 35 troopers on duty at any one time statewide, the MHP has relatively little presence in Park County. The Park County Sheriff's Office has limited resources with very limited communications. Lack of adequate staffing is a major issue. Generally, there are only one or two officers on duty at any given time. Park County consists of 2,626 square miles. The Livingston Police Department has equipment and manpower issues. There are generally two patrol units on duty in Livingston around the clock.

The Sheriff is responsible for Search and Rescue. There are approximately 50 search and rescue calls in Park County each year. During the winter recreation season, they are averaging 2-3 SAR calls per week in the Cooke City area. The area above Cooke City has major avalanche issues. There are frequent calls in the summer involving four wheel drive vehicles. In much of the area with the searches occur, there is even more limited communications. Park County does have a portable repeater for SAR operations. There are also incidents involving float boats on the Yellowstone River. With the increased use of GPS, there are more rescue calls than searches.

The Park County law enforcement agencies use a single channel for dispatch traffic. At the present time, there is a single transmitter on this channel. The agencies have access to the common mutual aid channels.

The Montana Highway Patrol is currently building out a statewide mobile data system. The first phase was installed in 5 counties (Lewis & Clark, Gallatin, Cascade, Yellowstone, and Silver Bow). The second phase of the project will extend the system through Park County to Billings. It is scheduled for completion this summer.

2.2.2 Park County Fire and Emergency Medical Services

There are 8 Fire Departments with a total of 9 fire stations in Park County (Livingston Fire, Park County Rural, Paradise Valley, Clyde Park City, Clyde Park Rural, Wilsall, Gateway Hose Company, and Cooke City). Three agencies provide EMS transport service in the County. They are Livingston Fire/Rescue (4 vehicles/ALS), Paradise Valley (1 vehicle/partial ALS); and Gardiner (1 vehicle/ upgrading to intermediate). In addition, the National Park Service responds from Yellowstone Park, if they are available, to Cooke City and the Gardiner area. Livingston Fire Rescue is dispatched on its own channel. The Cooke City Fire Department, Gateway Hose Company, and Gardiner Ambulance are dispatched by the National Park Service, Yellowstone National Park Dispatch Center. These departments primarily communicate on National Park Service channels. The remaining departments (Park County Rural, Paradise Valley, Clyde Park City & Rural, and Wilsall) use a common channel. Livingston Fire has a single site. There are two repeaters on the county fire channel. Both repeaters transmit and receive on the same frequency pair, but Use different continuous tone coded sub-audible squelch frequencies (CTCSS).

In 1990, the State of Montana developed a Mutual Aid and Common Frequency Plan. This plan provides 19 different channels for either mutual aid or common use throughout the state. Six of the mutual aid channels are designated for fire service use. Most of the mobiles and portables used by the Park County Fire Departments are multi-channel and have been programmed to permit access to many of the statewide mutual aid channels.

Except for Cooke City, the fire departments are dispatched by tone and voice pagers. Cooke City FD is dispatched by the Park Service making telephone calls to the list of firefighters.

The Livingston Health Care operates a 15-20 bed hospital. The Emergency Room is not staffed 24 hours a day. When there is no one on-duty at the ER, the EMS radio is monitored at the med-surgical nurses' station. The hospital is pursuing a Level 4 Trauma Center designation. They anticipate building a new hospital in the next 3-5 years.

Cooke City has 75 full-time residents. During the summer, there are about 300 residents. There is only one certified medical first responder in Cooke City year round. During the summer, there is a retired couple who assist her. The National Park Service usually has an ambulance stationed at the Northeast Gate to Yellowstone National Park. The closest hospital is 76 miles away in Cody, Wyoming. During the winter, the road is closed between Cooke City and Cody. The Livingston Hospital is 110 miles from Cooke City. In the summer, the calls received are more medical related while in the winter, the calls are more trauma related.

2.2.3 Park County Dispatch Centers

The Livingston/Park County Dispatch Center is located in the City/County Building. It is a separate department of the City of Livingston. The dispatch center is equipped with two full positions. In 2005, new Watson workstation furniture was installed. New Zetron radio consoles were installed in February, 2005. New Zetron 911 CPE was being installed at the time of this interview. A new generator and UPS were also being installed at the same time. In addition, as part of the same project, the grounding was being upgraded to R56 standard.

The dispatch center currently has 6 telecommunicators and the Dispatch Coordinator. One or two telecommunicators are on duty at any one time. The staff works 8 hour shifts. New telecommunicators must complete 40 hour basic training at the Montana Public Safety Academy. They must also complete on-line training on CJIN/NCIC operations and 16 hours of records training.

The dispatch center answers 911 calls for the entire county, except the Gardiner and Cooke City areas. 911 calls from those areas are answered by the Yellowstone National Park Dispatch Center at Mammoth Hot Springs, WY. The Livingston Dispatch Center provides wireline enhanced 911 services. They currently provide wireless Phase 0 service and are in the process of deploying Phase I. They plan to complete Phase I and II deployment by the end of the year. There are currently 4 incoming 911 trunks and 6 other lines in dispatch. Emergency Medical pre-arrival instructions are provided using material approved by the County's Medical Control Authority. In addition to serving the law enforcement, fire and EMS agencies, they provide after-hours dispatch for Park Electric Company. In 2004, the agency dispatched 11,341 police calls, 325 fire calls, and 738 medical/ambulance calls. The total number of calls dispatched in 2004 was over twelve percent more than the number of calls dispatched in 2002.

In addition to the communications function, the dispatch staff also provides clerical support to both the Livingston Police Department and the Park County Sheriff's Department. These duties include: processing fingerprint cards; entering court dispositions in records; maintaining arrest records/docket books; transcribing interview tapes; compiling monthly and yearly statistical reports; making copies of tapes for served entities; receiving city arrest bonds; recording city accident reports; recording rural fire burn permits; providing secretarial support for served entities; answering the court house switch board; preparing reports for City Court trials; dispersing of reports to City and County Attorneys, Social Services, etc; releasing reports to private citizens; warrant entry; assuring that officers complete field reports; assuring that supervisory review occurs; issuance of parking permits; issuance of transient vouchers; key control for building; release of vehicle impounds; run pawn slips; process concealed weapons permits; close out evidence and investigation files.

The dispatch center has a Sleuth Computer Aided Dispatch System. The system is approximately four years old. It is not interfaced with the 911 system. There is no redundant processor.

The system does not provide unit recommendations or fire run cards. It provides limited management reporting. The basic purpose of the system is incident based reporting. The dispatch center is preparing to replace the CAD system.

The National Park Service operates at twenty-four hour dispatch center at Yellowstone National Park (YNP) Headquarters in Mammoth Hot Springs, Wyoming. The YNP dispatch center serves as the 911 answering point for most of the park as well as for the Gardiner and Cooke City areas in Park County, MT. There are a total of eight positions with six positions fully equipped. Four of the positions are equipped with NCIC terminals. The center recently upgraded to Watson workstation furniture and Orbacom Liquid Crystal Display consoles.

The YNP dispatch center provides basic 911 service and Phase 0 Wireless 911. YNP Dispatch does not have a Computer Aided Dispatch System (CAD). The National Park Service is implementing an Incident Management and Reporting System (IMARS) for the park service. Evaluation of qualified proposals is anticipated to begin in March, with potential contract award in the spring of 2005. Subsequent to award and system configuration, the NPS pilot program is scheduled for testing in the summer of 2005 at Everglades, Lake Mead, Organ Pipe, Ozarks and Yosemite National Parks and by the U.S. Park Police (Washington DC).

2.2.4 Other Agencies

The Livingston Department of Public Works is responsible for water and sewer hook-ups, street maintenance and garbage removal. They have their own radio channel and have access to three of the Montana Mutual Aid Channels. The DPW has also installed telemetry on approximately one-half of their water and sewer facilities. The City of Livingston currently has approximately 3,400 residential water services. It is anticipated that an additional 2,000 services will be added in the next several years.

The Park County Road Department is responsible for maintaining county roads and bridges. They are responsible for maintaining 1,100 miles of road. The County maintains county roads even in the City. The Montana Department of Transportation maintains State roads even in the City.

The Park County road Department has its own radio channel. They receive interference on occasion from an unknown source. It also uses the mutual aid channels for communications.

2.3 Sweet Grass County

The Sheriff's Department provides law enforcement for the county and for the City of Big Timber under an interlocal agreement. The department includes the Sheriff, Under Sheriff, four full-time deputies, five full-time dispatchers, two part-time dispatchers, and 15 reserve officers for enforcement at special events. Fire protection is provided by a county volunteer fire department with one main station located in Big Timber and three substations located in Melville, McLeod, and Bridger Creek. The Sweet Grass County Ambulance Service provides emergency medical services including ambulance transport.

Sweet Grass County is primarily an agricultural area. The County has a population of 3,609 people. Approximately one half of the population is concentrated near Big Timber, which is the only incorporated town in the County. There is a palladium and platinum mine (the only one in the United States) in the southern part of the county. Sweet Grass County contains approximately 1,853 square miles. The Boulder River is a significant geographic feature of the County. The Boulder River Valley contains four church camps, several U.S. Forest Service campgrounds, several dude ranches, and a number of vacation cabins. Part of the Boulder River Valley is in Park County, but the only access by wheeled vehicle is through Sweet Grass County. During the summer, the population of visitors in this area can outnumber the permanent population of the County. The County is experiencing limited growth of permanent population.

The Sweet Grass County Public Safety and Public Service agencies use two primary channels – the law enforcement channel and the local government channel. New Motorola Quantar P25 capable repeater base stations were installed in April 2005. In addition to the primary site at Tin Can Hill, there is a transmitter located on Monument Peak on the law enforcement channel that provides coverage in the Boulder River Valley. The Sweet Grass County Ambulance Service is alerted to calls by means of tone and voice pagers operating on a separate channel. That channel is also used by the hospital/nursing home and for communications between the ambulance and the hospital and for dispatch to access the Monument Repeater.

The Sweet Grass County Sheriff's Office functions as the 911 answering point and dispatch center for the entire county. The County currently provides basic 911 service. The County is working on upgrading to enhanced 911. Wireless 911 calls are currently routed to the administrative lines (Phase 0). In 2004, the dispatch center received 188 wireline 911 calls and 609 wireless 911 calls. They dispatched 2,629 law enforcement incidents, 160-180 fire calls, and 270 emergency medical calls. Dispatch is normally staffed with two people during the day and one at night. In addition to dispatch duties, the dispatchers are responsible for civil process; concealed weapons permits; data processing; records maintenance; transcribing statements; processing warrants; monitoring child visitation exchanges; issuing livestock permits; and monitoring and tending to prisoners when necessary.

The Pioneer Medical Center consists of a 35 bed hospital, 25-bed nursing home, 16-unit assisted living facility, and a family practice clinic. Three of the beds are trauma beds. The facility is staffed by one full-time physician, one part-time physician, a physician's assistant, and a family nurse practitioner in addition to nursing and support staff.

The Sweet Grass County Road Department is responsible for maintaining county roads and bridges. They Use the local government channel. Sweet Grass County has approximately 570 miles of county roads. The county road department maintains the county roads and 35 miles of graveled state secondary roadway located in the Boulder Valley. The department consists of a road supervisor, five full-time employees, and three temporary employees.

The Montana Highway Patrol is currently building out a statewide mobile data system. The first phase was installed in 5 counties (Lewis & Clark, Gallatin, Cascade, Yellowstone, and Silver Bow). The second phase of the project will extend the system through Sweet Grass County to Billings. It is scheduled for completion this summer.

2.4 Meagher County

The Meagher County Sheriff's Department provides law enforcement services for the county. There are three volunteer fire departments in the county (White Sulphur Springs, Meagher County Rural, and Martinsdale). The Meagher County Ambulance Service provides service countywide.

Meagher County is a ranching area. The County had a population of 1,937 in 2000, and its area includes 2,354 square miles.

It is estimated that the population had increased by 2.3% to 1,977 in 2004. The County is midway between Glacier National Park and Yellowstone National Park. Highway 89, which is the main North/South road in the County runs directly from the North Entrance of Yellowstone National Park to Glacier National Park. As a result, there is significant tourist traffic passing through the county during the summer season. In addition, the Smith River is a renowned fishing and scenic river that flows through the county. There is also a large amount of Forest Service and other public access lands which attracts a number of recreational tourists. It is estimated that the County population triples in the summer with these visitors.

The Sheriff's Department uses one repeated channel for communications. The dispatch center has the ability to transmit on the same channel in a simplex mode. There are two transmitters on the County Fire channel. One is used for most of the county; the second transmitter is used for fire communications in the Martinsdale area. The ambulance service uses a separate channel to communicate with the hospital. The base station for that channel is located at the hospital. There is a general repeater channel, designated as the DES channel, which is used by all agencies. It is also used by the White Sulphur Springs Schools to communicate with their six school buses.

The Sheriff's Department is the public safety answering point for 911 calls in Meagher County and provides dispatch service for the Meagher County public safety and public service agencies. They provide Enhanced Wireline 911 service and Phase 0 Wireless 911 service. In 2004, the Sheriff's office received 253 911 calls and 13,103 administrative calls. They Use Positron Lifeline 100 model 911 customer premises equipment interfaced with a Geocom GeoLynx mapping system. In 2004, 515 police calls, 43 fire calls, and 70 emergency medical calls were dispatched. Paging (tone and voice) for all services is done over the DES channel.

There is one dispatcher on duty around the clock. A supervisor is also on duty during weekdays. In addition to the communications function, the dispatch staff also provides clerical support to both the Sheriff's Department. These duties include: creating and maintaining arrest files; creating incident reports and case files; warrant entry; providing transient assistance, issuing concealed weapons, catering, and market permits; performing duties as a matron; transcribing audio interviews; providing food bank referrals, and dealing with public walk-in traffic.

The Mountainview Medical Center functions as the hospital for the community. It is connected with a medical clinic and long-term care facility. The hospital has six hospital beds and thirty-one long-term care beds.

The Meagher County Road Department is responsible for maintaining county roads and bridges. They have their own radio channel. The Road department has 21 mobile units in service. The White Sulphur Springs Department of Pubic Works has one mobile unit and two portable units.

2.5 Madison County

There are two law enforcement agencies, six rural fire departments, one private fire department, and two emergency medical service providers (ambulances). The Madison County Road Department has three shops. The Madison County Sheriff's Office serves as the 911 public safety answering point for the county and dispatches all county and local public safety agencies.

Ranching and farming are the mainstays of Madison County. The county is composed of two parallel valleys – the Madison and the Ruby. A significant portion of the land in Madison County is part of the two national forests or under other federal or state control. Madison County had a population of 6,851 in 2000. The estimated population in 2004 was 7,079. This is an increase of 3.33% from the 2000 census. While the growth in permanent residents has been relatively low, there has been a significant increase in the number of vacation homes in the County. The upper portion of the Big Sky Ski Resort is in Madison County. Yellowstone Club and Moonlight Basin are two new developments in the same area in Madison County. Using the number of permits issued countywide for new septic systems as an indicator, the number of permits issued between 1999 and 2003, averaged 123 per year. In 2004, 214 new permits were issued. Many of these new homes are high value homes that are located in remote areas. Radio coverage is especially difficult in many of these remote areas.

The Madison County Sheriff's Office is the primary law enforcement agency in the county. The Town of Ennis has a single constable. The Sheriff's Department has nine sworn employees. In addition to the Sheriff and the Undersheriff, there is a Captain and five deputies.

The Sheriff's Department currently operates four different transmitter sites. All sites have a common output frequency. The Virginia City transmitter is a simplex base station. The other three sites are repeaters. They use the same input frequency. The Sheriff's Office does have a simplex tactical channel. The department uses the mutual aid channels and U.S. Forest Service channels for tactical communications and for communications in some areas where they are unable to access the primary channel.

The six fire departments (Madison Valley Rural, Harrison, Virginia City, Alder, Sheridan, and Twin Bridges) are alerted by tone and voice pagers on the Sheriff's channel. The departments on the Madison Valley side of the County (Madison Valley Rural and Harrison) are paged using the Norris Repeater. The Virginia City Fire Department and the departments serving the Ruby Valley (Alder, Sheridan, and Twin Bridges) are paged using the transmitter above Virginia City. The fire departments all use that same channel for communications with dispatch. The departments use the mutual aid channels and U.S. Forest Service channels for tactical communications and for communications in some areas where they are unable to access the primary channel. The fire departments also provide medical first responder service. Each of the departments has a "Quick Response Unit."

Both ambulance services (Ennis and Ruby Valley) are also alerted by tone and voice pagers on the Sheriff's channel in the same way as the fire departments. They also use the same channel to communicate with dispatch. There are two hospitals in Madison County. The Madison Valley Hospital is a nine bed facility in Ennis. They are currently seeking designation as a Level IV trauma center. There is a medical clinic co-located with the hospital. The Ruby Valley Hospital is a ten bed facility located in Sheridan. Both hospitals recently received a tone and voice pager equipped with the respective ambulance service tones so that the on-duty Registered Nurse can be alerted to possible incoming patients even when she is away from the nurse's station. Madison County also has two nursing homes. One is located in the vicinity of each hospital.

The Madison County Sheriff's Office is the 911 Public Safety Answering Point for Madison County and provides dispatch service for the public safety agencies in the County. Currently Madison County has Basic 911 service. A new TCI 911 switch has been purchased, but not yet installed. The County is in the process of implementing countywide addressing and developing a Master Street Address Guide (MSAG). It is anticipated that the addressing will be completed for all but the Big Sky area by this fall and Enhanced 911 can be implemented at that time. Mapping will also be implemented in dispatch at that time. There is a single position Motorola Centracom II console and a partial slave console. There is normally one dispatcher on duty at any time. The staff consists of four full-time dispatchers and two part-time dispatchers.

The Madison County Road Department has three separate districts that coincide with the County Commissioner Districts. Each road department district has its own shop. The Road Department has its own channel. The Road Department has a base station only at the Alder shop. For the other shops, communications are limited to mobile-to-mobile communications. The department does have access to designated mutual aid channels.

Parts of Madison County are in two different National Forests. Parts of the Madison Range (140,680 acres) along the County's eastern edge are in the Gallatin National Forest. A larger part of the county (692,000 acres) is in the Beaverhead-Deerlodge National Forest. The U. S. Forest Service has several transmitter sites in Madison County. There is a regional interagency dispatch center in Dillon that dispatches both federal (USFS & BLM) and state (DNRC) wildland fire suppression resources.

2.6 Montana Interoperable Communications Environment

Five different State of Montana agencies and departments have on-going programs that impact the planning effort for the SCMIC. Following is a brief overview of these various programs.

2.6.1 Public Safety Services Bureau/State Interoperability Executive Council

The Public Safety Services Bureau (PSSB) is part of the Information Technology Services Division of the Department of Administration. The Public Safety Services Bureau manages statewide planning of public safety communications and the State's 911 program. The bureau organizes plans, and works with local, state, federal, and various public service agencies in the development and implementation of a statewide strategic plan for public safety communications. To that end, the Public Safety Services Bureau assists state and local government agencies in identifying potential sources of local, state and federal funding for public safety communications infrastructure, makes recommendations on how to acquire funding, develops grant proposals, and evaluates other efforts to secure funding

The Statewide Interoperability Executive Council (SIEC) is charged with providing policy-level direction in matters related to planning, designing and implementing guidelines, best practices, and standard approaches to solve Montana's public safety communications interoperability problems and to leverage any opportunity in support of a statewide system, including seeking federal or other funding, for statewide interoperability.

The PSSB is also responsible for administration the State of Montana's 911 program. At the present time 18 jurisdictions in Montana (including Gallatin, Meagher, and Park Counties and the City of West Yellowstone) provide Enhanced 911. Madison and Sweet Grass Counties are in the process of implementing Enhanced 911.

The SIEC is encouraging pilot or *Concept Demonstration Projects (CDP).* The process is initiated by a regional consortium submitting a Project Abstract which is a description of the basic concept to be demonstrated by the project. If the abstract is approved by the SIEC, the PSSB will then assign a special projects coordinator to assist with the project.

The SIEC has adopted APCO P25/TIA 102-A as the standard for public safety communications systems in the State. Because of the high degree of usage in the state of the VHF - High Band portion of the spectrum, the SIEC is recommending that operations remain in this frequency band in order to facilitate both interoperability and an incremental, phased approach. Currently, most of the public safety entities in Montana use VHF – High Band for communications. Billings PD is the only law enforcement agency using 800 MHz, and Great Falls PD is the only law enforcement agency using UHF.

On August 5, 2005, the SIEC adopted a definition of *Interoperability* which states, "Interoperability refers to the ability of public safety emergency responders to work seamlessly with other systems or products without any special effort. Wireless communications interoperability specifically refers to the ability of public safety officials to share information via voice and data signals on demand, in real time and when needed."

Included in the adoption of the definition is the following *Technical Requirement*:

The technology needed to meet the Interoperability Definition is that public safety radio communications in Montana will be a <u>standards-based</u> <u>shared system of systems</u>. The radio system will be a <u>wide area system</u> for use by public safety responders.

Through the deployment of a migration plan that identifies the steps and process for each participating agency, the system will combine <u>P25</u> <u>trunked</u> and P25 digital/<u>analog</u> <u>conventional</u> technologies to provide <u>interoperable communications</u> among P25 <u>narrowband</u> <u>digital</u> trunked and existing conventional users.

All equipment must be compatible and seamlessly integrate with infrastructure equipment deployed in CDP 1 - Southwest Interoperability Project and CDP2 - Northern Tier Interoperability Project. It will operate narrowband in the VHF frequency range and will use a protected high-capacity digital microwave backbone for voice and data interconnect traffic.

The system will provide advanced channel management for the shared use of frequencies, seamless roaming throughout the respective trunked areas (footprint) and enhanced responder safety through embedded signaling, while at the same time enhancing interoperable communication with existing legacy VHF radios. At a lower level of interoperability, the current mutual aid channels will be maintained and available for use.

While all agencies recognize the optimum goal of a trunked system, they will need to migrate to trunking in a step/phased approach. With this ultimate goal, however, all agencies will purchase equipment that is trunking capable or upgradeable to trunking. Progression through these steps will vary in a given time based on operational needs, and ultimately funding available.

To date, 4 CDPs have been approved by the SIEC. CDP 2 (Southwest Interoperability Project) involves Lewis and Clark County. This includes Helena, the State Capitol. This CDP involves the installation of a P25 VHF digital trunked system. They received a $6M COPS Interoperability Grant to fund the project start-up. The State of Montana has requested an additional $2,000,000 in federal funding for next year to allow the addition of Jefferson and Broadwater Counties.

CDP 1 (Northern Tier Interoperability Project) involves the 12 counties that form the northern border with Canada. The project involves installing a digital microwave backbone linking the dispatch centers, EOCs, Montana National Guard armories, the Montana Highway Patrol, the Montana Department of Transportation as well as various Tribal and Federal agencies. The project also involves providing P25 digital radios and mobile data terminals. The project received extensive funding through the Wartime Supplemental Appropriation.

The State of Montana, with the approval of the legislative body, will contribute $3.6M (General Fund monies) toward the NTIP, integrating (or tying to) L&C County's upgrades (Master Zone Controller).

CDP 3 involves four counties (Anaconda-Deer Lodge, Beaverhead, Butte-Silver Bow and Granite) who have formed the I-15-90 Corridor Interoperable Communications Consortium to conduct a needs assessment of the current communication environment and write an implementation strategy for interoperable communications.

2.6.2 Montana Disaster and Emergency Services Division

The Montana Disaster and Emergency Services is a Division of the Montana Department of Military Affairs. The Montana DES serves as the State Administrative Agency for U. S. Department of Homeland Security (DHS) funding and other resources. The State Homeland Security Strategy for Montana is to build local and regional capabilities that support regional and statewide homeland security initiatives by effectively working in a multi-disciplinary manner to detect, mitigate, prepare for, respond to and recover from, a Weapons of Mass Destruction (WMD) terrorism incident. Interoperable communications projects have been identified as a high priority in the State Homeland Security Strategy. The second highest priority goal is to "Establish a statewide, interoperable public safety system that will link the independent wireless voice and data systems (incl. 9-1-1 and public safety radio systems) used by federal, state, local, tribal and private sector responders."

In 2001, the State performed a threat assessment. The 56 counties and 7 Indian Nations were prioritized based upon the assessment of both the threat of an incident occurring and the vulnerability to an incident. Each of the 63 jurisdictions was then ranked. Gallatin County has the second highest threat assessment in the state. Montana has traditionally attracted activist/extremist individuals and groups because of its low population, large geographic area, and relative isolation. Groups active in Montana vary from white supremacists to single issue groups, such as environmental extremists.

2.6.3 Montana Highway Patrol

The Montana Highway Patrol (MHP) is responsible for managing highway traffic safety in the state. It is the largest law enforcement agency in Montana, with about 200 officers and 70 civilian employees in eight districts throughout the state. The MHP is currently building out a statewide mobile data system.

The first phase was installed in five counties (Lewis & Clark, Gallatin, Cascade, Yellowstone, and Silver Bow). Local agencies are using the system as well. Currently, there is a microwave system linking Butte with Helena. Phase 2 of the mobile data system will extend the mobile data system east to Miles City in Custer County. As part of Phase II, the microwave will be extended from Butte through Bozeman to Billings. This extension will involve three microwave sites in Gallatin and Park Counties (High Flat, Bozeman Flats, and Sheep Mountain).

2.6.4 Montana Department of Transportation

The Montana Department of Transportation (MDT) is responsible for maintaining over 10,800 miles of highway and about 2,100 bridges. The Department of Transportation has five districts. Those districts are further subdivided into a total of ten divisions. Most of the SCMIC is in the Butte District and the Bozeman Division. MDT is moving to narrowband. They have no plans to move to digital nor are they considering trunked. The MDT has eight sites in the SCMIC area; two of those sites are County owned; three of the sites are shared with the USFS; two are MDT sites, and one is a leased site.

2.6.5 Montana Department of Natural Resources and Conservation

The Montana Department of Natural Resources and Conservation (DNRC) was established July 1, 1995, as the result of legislative reorganization of Montana's natural resource and environmental agencies. DNRC has nearly 500 employees organized into seven divisions: Centralized Services, Conservation and Resource Development, Forestry, Oil and Gas Conservation, Reserved Water Rights Compact Commission, Trust Land Management, and Water Resources. The Forestry Division is responsible for planning and implementing forestry programs statewide.

Forestry responsibilities include protecting Montana's natural resources from wildfire, regulating forest practices, and providing a variety of services to private forest landowners. Over 50.3 million acres of forest and non-forest state and private lands are protected by the state through a series of protection systems. These systems include forest fire districts, affidavit units and cooperative fire control counties.

Actual protection is afforded by the state, either through its own organization, or in support of county forces, or through contracts with the Forest Service, Bureau of Land Management, and the Flathead Indian Agency.

The DNRC Fire Bureau has jurisdiction in those areas where the state provides actual protection. They work closely with the US Forest Service. The DNRC has non-linked repeaters located in the areas where the DNRC has primary jurisdictions for wild land fire protection. The DNRC is in the process of replacing their base stations with narrow-band capable units. It will take approximately 3 more years to complete the process.

2.7 Federal Agencies

There is extensive interaction between various county departments and agencies and agencies of the federal government. The two federal agencies most involved are the National Park Service and the U.S. Forest Service. The National Park Service provides dispatch service and communications support for agencies in southern Park County as well as in portions of Gallatin County. A large portion of the land in the five counties is part of one of two National Forests. The U.S. Forest Service has a number of repeater sites throughout the five counties. There is frequent interaction between the Forest Service and local agencies, especially during fire season. All federal agencies are under Congressional Mandate to convert their operations to narrow-band by the end of this year. Both the National Park Service and the U.S. Forest Service are in the final stages of the conversion. Once that happens, the agencies in the five counties will have to have narrow-band capable equipment in order to communicate on either Park Service or Forest Service frequencies.

2.8 Missoula County/City of Missoula

The Missoula Area Consortium, consisting of Missoula County, the City of Missoula and other agencies. It is included in our review because the approach that they selected may be useful in the SCMIC. Missoula County and the City of Missoula have implemented a VHF High-band conventional system. There are five remote sites linked by microwave. These sites provide overlapping coverage. They have six to 10 channels at each site.

They are using Motorola Quantar repeaters base stations and a Motorola “Astro-TAC 300”comparator. The comparator selects the best received signal. The selected or voted audio is then rebroadcast over the selected transmitter. Field personnel do not have to manually switch between repeaters. Dispatch personnel may have to select the transmitter if there has been more than five seconds since the last transmission on the tower they want to use. The transmitter interface was built locally. The repeaters function like a simulcast system, but the interface inhibits all but the selected transmitter from actually transmitting. When they were installing the system, they chose repeater input frequencies in the upper portion of the VHF high band portion of the spectrum (158-159 MHz) and repeater output frequencies in the lower portion of the same band (151-155 MHz). This reduces the interference potential. They are looking to add simulcast zones to the system. Some limited use is being made of P25 digital communications with encryption.

TABLE 2-1
FREQUENCY SUMMARY

DESIGNATION	BASE TRANSMIT	BASE RECEIVE	UTILIZATION
North Repeater	154.995 MHZ	154.815 MHZ	Gallatin County North
South Repeater	155.700 MHZ	158.790 MHZ	Gallatin County South
Mobile Data	460.450 MHZ	465.450 MHZ	Gallatin County Paging - Bridger Ridge
Bozeman Deaconess Hospital	453.425 MHZ	458.425 MHZ	Gallatin County Paging - Public Works, Medical
Sanitation	453.625 MHZ	458.625 MHZ	Gallatin County Paging - Public Works - Sanitation
Parks	453.925 MHZ	458.925 MHZ	Gallatin County Paging - Public Works - Parks
Gallatin Co. Paging	458.425 MHZ	453.425 MHZ	Gallatin County Paging - Dispatch
County Paging	460.025 MHZ	465.025 MHZ	Gallatin County Paging - High Flat
Fire North	154.055 MHZ	158.880 MHZ	Gallatin Fire North
Fire West	154.145 MHZ	158.865 MHZ	Gallatin Fire West
Bozeman FD	154.250 MHZ	158.910 MHZ	Bozeman Fire Station 1
Bozeman FD	158.910 MHZ	154.210 MHZ	Bozeman Fire Department
Bozeman PD Tactical Repeater	154.650 MHZ	155.640 MHZ	Bozeman Police Department - Tactical
Bozeman PD	154.725 MHZ	155.670 MHZ	Bozeman Police Department
Bozeman PD	155.670 MHZ	154.725 MHZ	Bozeman Police Department
Gallatin Co. Roads	151.340 MHZ	159.240 MHZ	Gallatin County Public Works - Roads
Streets	158.760 MHZ	154.100 MHZ	Gallatin County Public Works - Streets
Bozeman Water	158.820 MHZ	156.015 MHZ	Gallatin County Public Works - Water
Sheriffs Office TAC	155.580 MHZ	Simplex	Gallatin County Sheriff Office - Tactical
White	155.280 MHZ	Simplex	State EMS/Hospital
USFS	164.825 MHZ	169.925 MHZ	U S Forestry Service
Highway Patrol	154.680 MHZ	155.460 MHZ	Montana Highway Patrol
			MADISON COUNTY
Sheriff	153.905 MHZ	155.025 MHZ	Madison County Sheriff
Sheriff	153.935 MHZ	Simplex	Madison County Sheriff
Norris Repeater	155.025 MHZ	153.935 MHZ	Madison County Sheriff
Ruby Repeater	155.025 MHZ	153.935 MHZ	Madison County Sheriff
Sheriff	155.025 MHZ	Simplex	Madison County Sheriff
			MEAGHER COUNTY
DES Repeater	155.025 MHZ	158.775 MHZ	Meagher County Sheriff
Martinsdale Repeater - DPL 132	155.025 MHZ	158.775 MHZ	Meagher County Sheriff
Sheriff	155.250 MHZ	158.970 MHZ	Meagher County Sheriff
Sheriff	458.700 MHZ	453.700 MHZ	Meagher County Sheriff - Paging
			PARK COUNTY
Rural Fire	154.160 MHZ	Simplex	Park County - Rural Fire
Fire South	154.415 MHZ	Simplex	Park County - Fire
North Repeater	154.415 MHZ	158.835 MHZ	Park County - Fire
Park County Law Enforcement	155.595 MHZ	Simplex	Park County - Police
White - Hospital	464.175 MHZ	469.175 MHZ	Park County Hospital, Livingston Memorial - Paging
Coulter Repeater	166.975 MHZ	166.375 MHZ	Park County Sheriff - Cooke City Search and Rescue (179.9 T/NAC)
Cooke City Repeater	153.830 MHZ	154.445 MHZ	Park County Sheriff - Cooke City Search and Rescue

TABLE 2-1
FREQUENCY SUMMARY

DESIGNATION	BASE TRANSMIT	BASE RECEIVE	UTILIZATION
			SWEET GRASS COUNTY
County Dispatch	154.040 MHZ	155.805 MHZ	Sweet Grass County - Sheriff
Law Repeater	154.980 MHZ	158.895 MHZ	Sweet Grass County - Sheriff
Monument Repeater	154.800 MHZ	158.730 MHZ	Sweet Grass County - Sheriff
	153.905 MHZ	Simplex	State Mutual Aid - Gold
	154.070 MHZ	Simplex	State Fire Mutual Aid - Red
	154.280 MHZ	Simplex	State Fire Command Control - Maroon
	154.265 MHZ	Simplex	State Fire Ground Ops - Coral
	154.295 MHZ	Simplex	State Fire Ground Ops - Scarlet
	153.830 MHZ	Simplex	State Fire Ground Ops - Ruby
	159.345 MHZ	Simplex	State Fire Repeater - Code Guard (156.7) - Ruby/Garnet
	155.280 MHZ	Simplex	State Local Hospital/Ambulance - White
	155.340 MHZ	Simplex	State Reg. Hospital/Ambulance - Tan
	155.325 MHZ	Simplex	EMS Central Region Dispatch - Gray
	155.385 MHZ	Simplex	EMS East/West Region Dispatch - Pink
	155.820 MHZ	Simplex	State DES - Brown
	155.160 MHZ	Simplex	National SAR - Violet
	155.220 MHZ	Simplex	State SAR - Purple
	151.220 MHZ	Simplex	DNRC - Yellow
	171.475 MHZ	Simplex	USFS - Common - Green
	161.825 MHZ	157.225 MHZ	GOLD Repeater-Fire Priority - Gold/Alpha
	161.850 MHZ	157.250 MHZ	GOLD Repeater-Law Enforcement - Gold/Bravo
	172.225 MHZ	170.475 MHZ	GOLD Repeater - Common MA - Gold/Charlie
	172.375 MHZ	170.575 MHZ	GOLD Repeater - Common MA - Gold/Delta
	155.475 MHZ	Simplex	National Law Enforcement - Blue
	155.790 MHZ	Simplex	State Law Enforcement MA - Silver
	153.800 MHZ	Simplex	State Tactical Team Coord. - Black
	151.400 MHZ	Simplex	State All-Risk Mutual Aid - Orange
	154.385 MHZ	Simplex	Gallatin County - County Fire Mutual Aid - Code Guard (192.8 T/R)

TABLE 2 - 2
NON - FIXED RADIO UNTILIZATION
CURRENT UNITS

AGENCY	NUMBER	NON-NARROWBAND CAPABLE MOBILES	NON-NARROWBAND CAPABLE PORTABLES	NON-NARROWBAND CAPABLE DESK TOPS	NARROWBAND CAPABLE MOBILES	NARROWBAND CAPABLE PORTABLES	NARROWBAND CAPABLE DESK TOPS
	GALLATIN COUNTY						
TOTALS	**1588**	**173**	**400**	**34**	**340**	**595**	**46**
Gallatin County 9-1-1	**0**	0	0	0	0	0	0
Bozeman Fire	**69**	0	0	0	23	44	2
Belgrade Fire	**241**	6	67	3	32	127	6
Fort Ellis Fire	**54**	5	10	0	18	20	1
Sourdough Fire	**174**	0	52	0	40	70	12
Gallatin County Sheriff	**112**	0	0	5	52	50	5
DES/EOC	**12**	0	6	6	0	0	0
Amsterdam Fire	**36**	1	15	0	9	10	1
Bridger Canyon Fire	**24**	0	0	0	10	12	2
Clarkston Fire	**32**	8	7	1	1	15	0
Big Sky Fire	**38**	0	0	0	13	25	0
Gallatin Gateway Fire	**0**	0	0	0	0	0	0
Gallatin River Fire	**24**	1	5	0	5	11	2
Manhattan Fire	**34**	0	0	2	10	22	0
Springhill Fire	**24**	1	16	1	2	4	0
Three Forks Fire	**31**	1	10	0	9	10	1
Willow Creek Fire	**53**	5	11	1	5	31	0
Yellowstone Fire	**8**	0	0	0	3	4	1
Belgrade Police	**6**	2	4	0	0	0	0
Three Forks Marshall	**18**	0	2	1	7	8	0
Manhattan Police	**9**	0	0	0	4	4	1
MSU Police	**23**	6	0	0	8	8	1
West Yellowstone Police	**10**	0	0	0	4	4	2
Bozeman Police	**121**	5	20	0	43	52	1
AMR	**25**	0	10	0	5	10	0
Bozeman Parks	**8**	2	6	0	0	0	0
County Roads	**83**	36	2	0	25	14	6

TABLE 2 - 2
NON - FIXED RADIO UNTILIZATION
CURRENT UNITS

AGENCY	NUMBER	NON-NARROWBAND CAPABLE			NARROWBAND CAPABLE		
		MOBILES	PORTABLES	DESK TOPS	MOBILES	PORTABLES	DESK TOPS
Bozeman Deaconess	**16**	0	8	1	4	2	1
HAM Radio/SAR	**76**	6	40	0	2	27	1
Three Forks Ambulance	**23**	3	20	0	0	0	0
Public Health	**17**	2	10	3	0	2	0
Water Treatment	**12**	6	5	1	0	0	0
Cemetary	**15**	3	8	0	4	0	0
Streets	**59**	36	17	6	0	0	0
Waste Water	**5**	3	2	0	0	0	0
Water Sewer	**35**	16	18	1	0	0	0
Public Works (UHF)	**34**	17	12	2	0	3	0
Parks (UHF)	**24**	2	14	0	2	6	0
Public Lands	**3**	0	3	0	0	0	0
MADISON COUNTY							
TOTAL	**348**	**69**	**149**	**8**	**34**	**83**	**5**
Madison County Health Dept	**0**	0	0	0	0	0	0
MC LEPC	**10**	2	2	0	4	2	0
MC Rural Fire	**0**	0	0	0	0	0	0
MC Hospital	**0**	0	0	0	0	0	0
Ennis Police	**2**	1	1	0	0	0	0
MC Nursing Homes	**8**	0	0	0	0	8	0
Ennis Public Works	**0**	0	0	0	0	0	0
Ennis Ambulance	**12**	2	10	0	0	0	0
Ruby Valley Ambulance	**21**	3	18	0	0	0	0
Ruby Valley Hospital	**3**	0	0	0	2	0	1
MC SAR	**44**	9	29	1	0	4	1
Virginia City Fire	**0**	0	0	0	0	0	0
West County Fire	**0**	0	0	0	0	0	0

TABLE 2 - 2
NON - FIXED RADIO UNTILIZATION
CURRENT UNITS

AGENCY	NUMBER	NON-NARROWBAND CAPABLE MOBILES	NON-NARROWBAND CAPABLE PORTABLES	NON-NARROWBAND CAPABLE DESK TOPS	NARROWBAND CAPABLE MOBILES	NARROWBAND CAPABLE PORTABLES	NARROWBAND CAPABLE DESK TOPS
Twin Bridges Fire	**15**	3	10	0	0	2	0
Alder Fire	**28**	2	12	1	5	8	0
Harrison Pony	**25**	0	5	0	9	10	1
Harrison RVFD	**26**	4	0	0	9	12	1
MC Rural Fire #1	**31**	7	21	1	0	2	0
Madison Valley Rural Fire Distri	**33**	3	7	1	4	18	0
Madison Valley Hosp	**11**	0	8	1	0	2	0
Madison Valley Hosp - Lab	**1**	0	0	0	0	1	0
MV Roads	**10**	0	3	0	1	6	0
Twin Bridges Roads	**21**	11	5	0	0	4	1
Roads District #1	**18**	11	2	1	0	4	0
Madison County Sheriff	**29**	11	16	2	0	0	0
MEAGHER COUNTY							
TOTAL	**183**	**11**	**35**	**1**	**56**	**70**	**10**
Meagher County Sheriff	**30**	2	5	0	9	12	2
Meagher County Fire	**43**	3	10	0	11	19	0
Meagher County EMS	**0**	0	0	0	0	0	0
Meagher County Public Works	**3**	0	0	0	1	2	0
Meagher County Schools	**7**	0	0	0	6	0	1
WSS Fire	**14**	0	2	0	2	9	1
SAR	**26**	4	2	1	6	12	1
Meagher County Ambulance	**18**	2	12	0	0	4	0
WSS Road Dept	**22**	0	0	0	21	0	1
Meagher County Public Health	**20**	0	4	0	0	12	4
PARK COUNTY							
TOTAL	**403**	**54**	**152**	**8**	**115**	**66**	**8**
Park County Dispatch	**0**	0	0	0	0	0	0
Gardiner Ambulance	**21**	1	16	1	1	2	0
Park County Fire Council	**0**	0	0	0	0	0	0

TABLE 2 - 2
NON - FIXED RADIO UNTILIZATION
CURRENT UNITS

AGENCY	NUMBER	NON-NARROWBAND CAPABLE MOBILES	NON-NARROWBAND CAPABLE PORTABLES	NON-NARROWBAND CAPABLE DESK TOPS	NARROWBAND CAPABLE MOBILES	NARROWBAND CAPABLE PORTABLES	NARROWBAND CAPABLE DESK TOPS
Gardiner Fire	**22**	0	16	1	3	2	0
Wilsall Fire	**15**	6	6	0	0	2	1
Paradise Valley Fire	**21**	0	0	0	8	12	1
Rural Fire District #1	**54**	6	28	0	15	2	3
Livingston Fire & Rescue	**42**	10	12	1	2	17	0
Clyde Park City Fire	**9**	0	0	1	2	6	0
Cooke City Fire	**11**	0	4	0	2	4	1
Clyde Park Rural Fire	**25**	2	14	1	6	2	0
Livingston Police	**23**	0	16	0	7	0	0
Park County Sheriff	**55**	5	30	2	16	2	0
Park County Public Works	**0**	0	0	0	0	0	0
Park County Roads	**50**	15	2	1	30	1	1
Livingston Solid Waste	**4**	1	2	0	0	1	0
Livingston Public Works	**51**	8	6	0	23	13	1
SWEET GRASS COUNTY							
TOTAL	**153**	**12**	**36**	**3**	**48**	**49**	**5**
Sweet Grass County Sheriff	**47**	2	30	2	11	0	2
Sweet Grass County EMS	**9**	0	0	0	3	5	1
SG Roads	**25**	5	1	0	14	4	1
SG Fire	**72**	5	5	1	20	40	1

3.0 COMMUNICATIONS PROBLEMS AND CONCERNS

This section describes the deficiencies found in the existing two-way and paging systems. A general overview of the problems and concerns is presented followed by a county-by-county detailed list.

3.1 Radio Users Surveyed

In order to gain a clear understanding of the situation faced by each of the agencies and jurisdictions involved in the SCMIC, CTA Communications conducted over sixty-three interviews with various agencies and individuals. The interviews provided us with operational considerations during the face-to-face interviews and through additional written survey responses. In addition, CTA conducted twenty-seven site surveys and six dispatch center surveys. APPENDIX B contains a list of all of the interviews conducted as well as the interview records. APPENDIX C contains the completed site surveys for each of the sites that CTA was able to survey.

3.2 Problem Assessment Summary

Following is a general summary of the problems and concerns with the current communications environment as either expressed to CTA in interviews and written surveys or observed by CTA during our site surveys. More detailed explanation is contained in the county-by-county descriptions that follow.

3.2.1 Lack of Coverage

There is a significant lack of coverage in all counties. Some counties have more serious issues than others.

Complaints about dead spots and poor voice coverage areas are common in each of the five counties participating in the South Central Montana Interoperability Consortium. Overall, voice coverage is not adequate. Contact is often lost when operating with either portables or mobiles. Often the areas of poor coverage are also areas where incidents frequently occur that require a public safety response. If personnel cannot communicate over their radios, they often must set up multiple unit relays in order to communicate.

They often must resort to attempting to contact another agency's dispatcher, such as the U.S. Forest Service, operating on that agency's frequency. The coverage issues must be addressed before any new technology can be employed.

3.2.2 Design Issues

Design Issues with some of the current systems in use contribute to the problem. Most of the counties use multiple repeaters on the same frequencies with different continuous tone coded sub-audible squelch frequencies. In other cases, the repeaters use different frequencies. Users must manually switch channels to access a repeater with coverage in the geographic area they are in. Not only does this create challenges for the field user, it inhibits communication between the field unit and the dispatch center. The dispatch center must monitor multiple channels and traffic on one channel may cause missed communication on another channel. In addition, control stations are used for the dispatch centers to access the repeaters. This does not allow the dispatcher to preempt the channel if needed to broadcast emergency traffic.

3.2.3 Transmitter Sites

Insufficient attention has been paid to the transmitter sites. Not only are many of the facilities less than adequate, the lack of attention to good site engineering and maintenance has led to reduced coverage in a number of instances. Public safety communications systems must function under all conditions. The equipment building or room must be of sufficient size to hold the radio plus provide room for any future expansion. The facilities housing public safety transmitters and receivers need to be maintained in good condition and capable of withstanding the various environmental forces and provide protection from the elements and vermin. In addition, there needs to be appropriate levels of heating, ventilation, and air conditioning (HVAC) because of the sensitivity of the electronic equipment to fluctuations in temperature and humidity. Adequate electrical service must be provided to handle the anticipated load. Emergency power needs to be provided. Both an electric generator and an uninterruptible power supply should be provided. Fencing is strongly recommended for security purposes as are alarms. Adequate grounding is essential to minimize the risk of the equipment damage due to electrical fluctuations and lightning as well as to optimize the performance of the existing equipment.

In addition to the inadequate facilities, we observed a number of instances where good engineering practices, particularly with respect to antenna placement, were not followed. Adequate separation of antennas, either vertical or horizontal, is essential to minimize the risk of interference between channels. The lack of adequate separation can also result in reducing the effective range of the transmitter or receiver. This further contributes to the coverage problems. Maintenance is important to assure the systems continue to operate as designed. Over time various components, such as the antenna system, can deteriorate resulting in reduced performance. The conditions observed at some of the sites indicate that some of the antennas and coax need replacement or repair. The fact that the reported coverage is less what reliable coverage prediction software predicts for the site indicates that there may be performance issues with that site. TABLE 3-1 summarizes the conditions observed at each of the sites surveyed.

3.2.4 Obsolete Equipment

Some agencies have obsolete equipment; some are using lower grade equipment which does not perform as well as public safety grade equipment. A number of the agencies in the five counties are using relatively inexpensive radio equipment. This equipment generally isn't what is considered "public safety grade" equipment. While the units are low cost, they also lack many of the features the public safety grade radios have and are much more of a challenge to maintain. As a result, more problems occur when these radios are exposed to the kind of demands placed on them by public safety agencies. In addition, they may lack some of the features of the typical public safety radio and may transmit at lower power levels than the more typical public safety radio. These lower power outputs reduce the range that the radios provide effective communications thereby increasing the coverage problems. In addition, a number of agencies are using older equipment, some of which has been obtained as used equipment. Some of that equipment is no longer supported by the manufacturer which means that repair parts are no longer available. Much of the older equipment is not capable of meeting the narrowband requirements. Not only is that equipment not capable of meeting the FCC narrowband requirement, it is not capable of migrating to the digital mode or the P25 mode. It will not meet the compatibility requirements as adopted by the SIEC.

3.2.5 Operational Issues

Operational issues such as the lack of training and procedures for responders, contribute to the problems as well. Radio users are interfering with each other by operating their radios inappropriately or improperly. In many cases this is caused by a lack of training and by a lack of well defined standard operating procedures or guidelines. Unless responders having the methodology (planning and training) and the motivation (a willingness to comply with their training and procedures),; communications failures can be just as severe as those that occur because of the lack of facilities and coverage.

3.2.6 Lack of Back-up

There is a lack of back-up facilities for the dispatch centers. Only Gallatin County has a back-up facility, and at the time of our visit, it had limited capabilities.

The National Fire Protection Association Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (NFPA 1221) recommends that:

Each jurisdiction shall maintain an alternative communications facility that meets both of the following criteria:

(1) The facility shall be capable, when staffed, of performing the emergency functions provided at the communications center.

(2) The facility shall be separated geographically from the primary communications center at a distance from the alternative facility.

Each jurisdiction shall develop a formal plan to maintain and operate the alternative communications facility. The plan shall include the ability to reroute incoming alarm traffic and to process and retransmit emergency alarms.

While Gallatin County has recently constructed an Emergency Operating Center (EOC) that has some capabilities for backing up the Gallatin County dispatch center, the EOC was not fully capable of performing all of the emergency functions provided at the dispatch center. None of the other counties had back up facilities meeting the intent of the standards.

At least two of the dispatch centers (Park and Sweet Grass Counties) are located in close proximity to major rail lines that have frequent trains carrying hazardous materials.

3.2.7 Dispatch Space

There is a lack of available space in each of the dispatch centers. This is especially true in the amount of space provided as an equipment room.

Public safety communications systems are increasingly dependent on technology. Typically an enhanced 911 system includes the installation of a computerized 911 switch at the dispatch center. Dispatch centers are installing computer based mapping systems to locate call locations, especially wireless callers. Radio consoles are often computer based. Departments are using computerized records keeping systems such as computer assisted dispatch systems. Consequently, it is not unusual for a typical dispatch position to have multiple monitors and keyboards. Frequently a dispatch position is equipped with four or more monitors. All of the dispatch centers in the five counties lack space for the addition of any more positions. In addition, with the computerization of the dispatch center equipment, there is an ever increasing need for more space in the equipment room. None of the centers has adequate room in the equipment room. In addition, as with the sites, there has not been sufficient attention paid to such things as the electrical circuits, grounding and other similar items that should be a part of routine maintenance and upkeep.

3.3 Gallatin County

This section describes the problems found by the CTA survey team in Gallatin County. They are not listed in order of priority.

3.3.1 Limited Coverage

Complaints about dead spots and poor voice coverage areas were common. Numerous areas were identified where coverage is difficult at best especially on the Fire North and North (law enforcement) repeater. Within the City of Bozeman, there are a number of areas, especially in the west end of town and the Law and Justice Center where portable and in-building coverage is very poor. The Bozeman Police Department reported significant problems with both their dispatch channel and their tactical channel. It appears that there is a high amount of radio frequency noise in the area of the dispatch channel repeater site at the water tower. In addition, the tactical channel repeater, located on the campus of Montana State University, is subject to frequent interference from MSU channels. Coverage issues also exist in many of the canyons and river bottom areas. Overall voice coverage is not adequate. If personnel cannot communicate over their radios, they must either move to a different location, which is not always feasible or use a cellular phone if coverage exists. They often are forced to resort to contacting a dispatcher operating on another agency's channel, such as the U.S. Forest Service or the National Park Service, on that agency's frequency.

3.3.2 Pager System Limitations

While dual encoders have been installed, the paging system has limited redundancy. The Dispatch Center also has no way of knowing if the paging system has failed. There have been several times that the system has failed and the dispatch center was not aware of the problem. Some of the paging transmitter sites are connected by an above ground telephone line which leaves them vulnerable to outages. The paging system has no diagnostic package to detect when a site is down. NFPA 1221 (the Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems) prescribes that the dispatch circuit(s) be monitored for integrity. "Wired circuits, microwave carrier channels, dedicated telephone circuits, and devices upon which transmission and receipt of alarms depend shall be monitored constantly to provide prompt warning of trouble that will impact reliability." Some departments report receiving phantom pages and incomplete pages. There are areas of the County where pager coverage is limited. A number of users reported issues with the particular model of pager being used. The displays were described as challenging to read especially at night while responding to a call.

There are issues at times with the interface between the CAD system and the paging system which results in the information not being received by those being alerted. With the fact that the dispatch center makes no verbal announcement of calls, often times there is a significant delay before the fact that there was a problem with the dispatch is known.

3.3.3 Operational Issues

A number of users reported issues with the operation of the dispatch center. Many of the issues involved not being able to receive an answer from dispatch when calling. These issues may be tied to the structure of the radio systems and the number of dispatch staff on duty at any one time. The number of dispatch channels used (5) is more than the number of dispatchers on duty (3). That means that each dispatcher must monitor more than one channel. In addition, the dispatchers are responsible for answering 911 and other incoming telephone calls. Some user agencies reported unacceptable delays in dispatching emergency calls. NFPA 1221 stipulates that "Ninety-five percent of alarms shall be answered within 15 seconds, and ninety-nine percent of alarms shall be answered within 40 seconds. Ninety-five percent of emergency dispatching shall be completed within 60 seconds." CTA personnel received a number of reports of incidents where the dispatch times were well in excess of the standards. These operational issues have led to a loss of confidence in the dispatch system. The center currently is equipped with four positions. There is no room to easily expand the center in its current location. In addition, the dispatch center equipment room is filled to capacity.

3.3.4 Reliability

While the City of Bozeman has recently completed construction of a new Emergency Operating Center with some capability to serve as a back-up for the dispatch center, the EOC was not yet fully capable of backing-up the dispatch center. In addition, some of the remote transmitter sites were not in good condition. As noted above, public safety systems must function under all condition. The equipment building or room must be of sufficient size to hold the radio plus provide room for any future expansion. The facilities housing public safety transmitters and receivers need to be maintained in good condition and capable of withstanding the various environmental forces and provide protection from the elements and vermin.

During our site surveys, we noted that several of the site structures were in poor condition. In addition, there needs to be appropriate levels of heating, ventilation, and air conditioning (HVAC) because of the sensitivity of the electronic equipment to fluctuations in temperature and humidity. Adequate electrical service must be provided to handle the anticipated load. Emergency power needs to be provided.

Both an electric generator and an uninterruptible power supply should be provided. Fencing is strongly recommended for security purposes as are alarms. Adequate grounding is essential to minimize the risk of the equipment damage due to electrical fluctuations and lightning. The Telecommunications Industry Association (TIA) has developed standards for grounding and bonding for telecommunications. The major radio equipment manufacturers have further refined those standards. CTA Communications has developed specifications for grounding and bonding. Our inspections of the sites and of the Dispatch Center indicated that considerable attention needs to be paid to bringing most of the sites up to standards. The lack of attention paid to the conditions at the sites has led to equipment outages which impacts the ability of the system to provide reliable coverage. CTA does note that since we did the original site surveys in March and April, 2005, Gallatin County has begun taking steps to improve conditions at some of the sites.

In addition to the inadequate facilities, we observed a number of instances where good engineering practices, particularly with respect to antenna placement, were not followed. Some users reported interference issues caused by co-located transmitters interfering with the selected transmitter. In addition, in some cases, the receive frequency of one repeater is close to the transmit frequency of another repeater located at the same site. The output from the second repeater tends to reduce the receiver sensitivity of the first repeater. Adequate separation of antennas, either vertical or horizontal, is essential to minimize the risk of interference between channels. The lack of adequate separation can also result in reducing the effective range of the transmitter or receiver. This further contributes to the coverage problems.

3.3.5 Co-Channel Interference

Other users outside the county who are legally or illegally transmitting on the same channel cause co-channel interference.

Interference results in lost calls and unintelligible transmissions. While the use of tone-coded squelch reduces some of the interference, some of the co-channel users are also using the same tone squelch codes. While the use of radio frequencies is coordinated by the Federal Communications Commission to minimize the potential for interference, tone squelch frequencies are not part of the coordination process. Gallatin County users reported receiving interference on several different channels. The new Lewis and Clark County system was cited as the cause of the interference in several cases.

3.3.6 Congestion

During emergencies, routine work must wait until the radio channel is made available. Work must be delayed as personnel wait for emergency or special calls to be answered and completed. Different agencies and functions operate on the same channel. Agencies must listen to communications that do not involve them. Some users lack the necessary self-discipline to limit non-essential communications. Gallatin County agencies reported instances where channel congestion was a problem. This may be due, in part, to the lack of consistent system-wide procedures and training.

3.3.7 Overcrowding

There are too many conversations on some of the channels. Routine and emergency transmissions share the same channel. This results in excessive "wait time" when users must hold their transmissions until the channel is available. It is similar to standing in line to check-out at a store. The Association of Public-Safety Communications Officials, International recommended that the average wait time not exceed five seconds. As the demand for communications increased consistent with the growth of population and the citizen expectation of service, overcrowding has become extremely serious at times and will affect the ability of public safety personnel to react in emergencies. CTA received reports of wait times being unacceptably long at times, particularly on both the Bozeman Police Department Channel and the North Repeater. Again, some of the problem may be due to the lack of consistent procedures and user training.

3.3.8 Self-Interference

Radio users are interfering with each other by operating their radios simultaneously and talking over one another. Usually this is an unintended side effect resulting from the radio user being in an area where he cannot hear those with whom he is interfering. This is especially true when units are using a repeater transmit frequency in a simplex mode.

3.3.9 Multiple Frequency Bands/Incompatible Equipment

While the vast majority of agencies and departments in Gallatin County are operating within the VHF High Band portion of the radio spectrum, there are two notable exceptions. The Bozeman Department of Public Works has two divisions that are operating on a UHF channel. This effectively isolates them from another public safety or public service agency in the area. In an emergency situation, coordination is hampered by the lack of access. In addition, the Gallatin County 911 center does not monitor the Department of Public Works VHF channel.

Yellowstone Club operates a UHF trunked system. While Yellowstone Club is in Madison County, the only public access is through Gallatin County. Should an emergency occur, because of the incompatibilities between both the frequency bands and the technology used, communications would be severely hampered. The Yellowstone Club Fire Department is equipping their apparatus with radios and portables capable of communicating with both Gallatin and Madison Counties.

Of even more concern is the move to narrowband by the agencies of the federal government. The federal agencies are under a Congressional mandate to move all of their operations to narrowband this year. Gallatin County agencies interact considerably with the U.S. Forest Service and the National Park Service. Both of those agencies are in the final stages of narrowband implementation. While most of the newer mobile and portable radios being used by Gallatin County agencies are capable of narrowband operation, some agencies have equipment that is not capable of narrowband operation. Once the federal agencies complete the conversion to narrowband, the non-narrow band equipment will not be able to communicate on the federal frequencies.

3.3.10 Lack of Mobile Data Communications

While the Bozeman Police Department and the Gallatin County Sheriff's have begun to use mobile data computers as part of the start up of the statewide mobile data project, their usage of the computers is limited at this time to CJIN inquires and limited inquiries of the records management system. The mobile data system is not interfaced with the computer aided dispatch system.

It currently does not provided field reporting or mapping. Functions that the data system can support are currently handled by voice communications or cellular phone. This causes increased utilization of available voice channels.

3.4 Madison County

This section describes the problems found by the CTA survey team in Madison County. They are not listed in order of priority.

3.4.1 Limited Coverage

Almost every user that we talked to in Madison County identified limited coverage as a significant issue. There are significant areas of the County where mobile and portable coverage was described as poor or non-existent. By way of example, one area that was mentioned by multiple users is the "Bear-Trap Gulch" on Highway 84 between Norris and Bozeman. Not only is there no two-way radio coverage, there is also no cellular coverage. Sometimes the departments have to use 4 or 5 vehicles to relay. There is an average of 2-3 tractor trailer incidents with hazardous materials issues in this area per year. So far this year there have been 12 motor vehicle accidents in this area. The area with the most accidents is between Mile Marker 3 and 10, especially around mile marker 7.

The Big Sky Ski Resort and surrounding mountain village and surrounding area is also a significant problem area. The upper portion of the Big Sky area is in Madison County. Yellowstone Club and Moonlight Basin are the largest of several developments in the same area in Madison County. At the present time, there is no direct communications between that area and the rest of Madison County and somewhat limited communications with Gallatin County. In addition, access to the area at this time is only through Gallatin County.

There currently is no secondary means of access. There is a gravel and dirt road, the "Jack Creek" road that is a private road running from the Big Sky area to the Town of Ennis. The use of this road is seasonal due to the condition of the roadway. Communications in the Jack Creek Canyon area is extremely limited.

Numerous other coverage problem areas were identified to CTA. We have noted those areas on maps.

3.4.2 Congestion

All public safety agencies in Madison County share the same channel. While this may be acceptable when there is no fire or ambulance activity, when an incident requiring multiple agency response occurs, the channel quickly becomes congested and communications are limited. Some users lack the necessary self-discipline to limit non-essential communications. This may be due, in part, to the lack of consistent system-wide procedures and training.

3.4.3 Obsolete/Incompatible Equipment

Much of the subscriber equipment (mobile and portable radios and pagers) have been obtained used. In fact many of the handheld or portable radios were obtained as surplus equipment from the U.S Forest Service. The normal life cycle of mobile and portable equipment when used by public safety agencies is approximately seven years. Much of the equipment being used in Madison County is more than fifteen years old. As a result the equipment may not be operating at peak capacity. It is subject to more frequent breakdowns. Repair parts may be difficult if not impossible to get. The diversity of the equipment also increases the maintenance issues especially in terms of programming the radios and keeping adequate batteries and functional charging equipment as well as repairing the various makes and models of radios being used.

In addition most, if not all, of the older equipment is not capable of narrowband operation. Madison County agencies interact frequently with various federal agencies, especially the U.S. Forest Service and the Bureau of Land Management during wildfire season. Because of the coverage limitations noted above, Madison County agencies frequently have to use USFS channels in order to communicate.

The federal agencies are under a Congressional mandate to move all of their operations to narrowband this year. Both of the USFS and the BLM are in the final stages of narrowband implementation. Once the federal agencies complete the conversion to narrowband, the non-narrow band equipment will not be able to communicate on the federal frequencies. The practical implications of the federal mandate is that Madison County must insure that it has at least a minimal capability to operate in the narrowband mode this year instead of waiting until the FCC 2013 mandate.

The Madison County Sheriff's Department is using a Motorola Centra-Com II console. Motorola no longer supports that model, and repair parts are not available from the manufacturer. As a result, it is quite difficult to repair the equipment and keep it functional.

3.4.4 Reliability

Public Safety Communications Systems must function under all conditions. The systems are needed the most when the conditions are the worst. The facilities housing public safety transmitters and receivers need to be maintained in good condition and capable withstanding the various environmental forces and provide protection from the elements and vermin. In addition, there needs to be appropriate levels of heating, ventilation, and air conditioning (HVAC) because of the sensitivity of the electronic equipment to fluctuations in temperature and humidity. Adequate electrical service must be provided to handle the anticipated load. Emergency power needs to be provided. Both an electric generator and an uninterruptible power supply should be provided. Fencing is strongly recommended for security purposes as are alarms. Adequate grounding is essential to minimize the risk of the equipment damage due to electrical fluctuations and lightning.

The Telecommunications Industry Association (TIA) has developed standards for grounding and bonding for telecommunications. The major radio equipment manufacturers have further refined those standards. CTA Communications has developed specifications for grounding and bonding. These specifications are based on industry standard recommendations as well as the recommendations of the major radio vendors. None of the four sites in Madison County that we surveyed met those standards. Two of the sites are in urgent need of correction. The most critical of these is the site on the Virginia City Hill.

The importance of this site in the current configuration cannot be overstated. Should this site fail, all communications fail. Not only is there a transmitter on the Sheriff's Department frequency, the links to the Norris and Baldy repeater sites are also located there. There is no emergency generator. There is a battery back-up system that will provide approximately two hours of operation on the batteries. The building is in poor condition, and the grounding is inadequate. According to information provided to CTA Communications by the Montana Division of Emergency Services, Montana is one of the most-seismically active states in the Unites States.

The largest earthquake in Montana and the 14th largest recorded in the US occurred in 1959 near Hebgen Lake on the Gallatin/Madison County border. That earthquake, a 7.5 magnitude quake, caused 28 deaths and damages of $71,000,000 in 2004 dollars. The United State Geological Survey classifies the southern end of the Madison Valley as being the most susceptible in Montana to future earthquakes. Should another earthquake occur in the area, it is highly likely that the Virginia City Hill site would become inoperable thus crippling emergency response efforts in Madison County.

The Ruby repeater site is also significantly below industry standards for site construction. The shelter is inadequate in size, there is no grounding or emergency power.

In addition, no back-up site exists for the Sheriff's Office Dispatch Center in Virginia City. As noted, in 3.2.6 above, NFPA 1221 recommends that there be a back-up center capable of performing all of the functions of the primary center.

No such center exists. In addition the amount of room available for the dispatch center is inadequate, especially with respect to the equipment room. Currently the console central electronics bank is in the boiler room. The room is excessively warm. Grounding is non-existent. The electrical service is inadequate. Because Virginia City is a historic area, significant limitations exist on what modifications can be made.

3.4.5 Self Interference

Because of the configuration of the system, with three repeaters and a simplex transmitter operating on the same frequencies and the fact that users in one valley can't hear users in the other valley, users often interfere with each other Usually, this is an unintended side affect resulting for the radio user being in an area where he can not hear those with whom he is interfering. In addition, both the Baldy and Ruby repeaters use the same tone coded squelch frequencies. Since the repeaters are relatively close to each other, this creates a zone where the repeaters interfere with each other blocking communications.

3.4.6 Co-Channel Interference

Other users outside the county who are legally or illegally transmitting on the same channel cause co-channel interference. Interference results in lost calls and unintelligible transmissions. While the use of tone-coded squelch reduces some of the interference, some of the co-channel users are also using the same tone squelch codes. While the use of radio frequencies is coordinated to minimize the potential for interference, tone squelch frequencies are not part of the coordination process. The Madison County Sheriff's Office receives interference from Meagher County on the Madison County tactical channel.

3.4.7 Lack of Warning System

The Town of Ennis is on the Madison River. Much of the Town is in the area that would be flooded if the Hebgen Lake or Earthquake Lake dams failed, which it could in another earthquake. It would take 2-8 hours for the crest to reach Ennis. There is no warning system. Similar issues exist below the Ruby Reservoir.

3.4.8 Inadequate Hospital Communications

Both hospitals in Madison County report significant problems with communications. Hospital/ambulance/QRU communications are problematic.

In addition, both hospitals have great difficulty contacting off-duty staff when needed. Similar concerns were expressed by the Madison County Nursing Homes.

3.4.9 Poor Commercial Mobile Radio Coverage

Numerous users reported that the commercial mobile radio service (CMRS) coverage (cellular and personal communications service) was very limited. With the land mobile radio coverage issues that exist, the lack of CMRS coverage becomes even more evident.

3.4.10 Lack of Regional Interoperability

Madison County borders the State of Idaho. While there is reasonably good interoperability among Montana agencies, there is no interoperability with Fremont County, Idaho. The dispatch center also reported that they are not able to communicate easily with surrounding agencies.

3.4.11 Operational Issues

Operational Issues such as the lack of training and procedures for responders, contribute to the problems as well.

Radio users are interfering with each other by operating their radios inappropriately or improperly. In many cases this is caused by a lack of training and by a lack of well defined standard operating procedures or guidelines. Without responders having the methodology (planning and training), communications failures can be just as severe as those that occur because of the lack of facilities and coverage.

3.4.12 Insufficient Equipment

A number of user agencies reported that they did not have an adequate amount of equipment. The County Road Department does not have base stations at two of its shops.

The Alder Fire Department does not have a base station at the fire station. Neither search nor rescue base is equipped with a base station. Various agencies reported they did not have enough mobile and portable radios and pagers. Several agencies have no equipment capable of narrowband operation. With the move by the federal agencies to narrowband operation, these agencies will not be able to communicate with the federal agencies. In addition, a number of the volunteers with various agencies have purchased radios with their personal funds. These units generally are not narrowband-capable.

3.4.13 Lack of Secure Communications

There is no encryption available. Communications of sensitive communications must rely on unsecured channels or cell phones. This not only creates privacy concerns with the transmission of sensitive medical information, it also can cause increased risks to law enforcement officers involved in covert or dangerous operations. The lack of secure communications is also a significant concern for medical communications, especially for communications between the ambulance or QRU and the medical control physician who may or may not be at the hospital.

3.4.14 Lack of Mobile Data Communications

The agencies do not have data capabilities. Functions that a mobile data system could support are currently handled by voice communications over the radio system or cellular phone. This causes over utilization of the voice channel. With the rapid development that is occurring in Madison County, responding agencies report frequent difficulties in locating addresses. Computer based mapping would assist in pinpointing the location of an incident. It would also be of assistance in the event of a major incident, such as a wildfire.

3.4.15 Limited Paging Capacity

The paging encoder currently in use at the Madison County Sheriff's Office has a capacity of twenty-four paging codes.
It is filled to capacity with the exiting users. There are a number of users who have a need for paging but cannot be accommodated due to the lack of capacity. There is no back up for the existing encoder.

In addition, the limitations of the existing radio coverage that exists are even more apparent with paging. The typical tone and voice pager being used in Madison County requires a significantly stronger radio signal than a portable radio.

3.5 Meagher County

This section describes the problems found by the CTA survey team in Madison County. They are not listed in order of priority.

3.5.1 Limited Coverage

Complaints about dead spots and poor voice coverage areas were common among the majority of the users interviewed. Numerous areas were identified where coverage is difficult at best. Overall voice coverage is not adequate. The paging coverage is even more limited. Once a user is a distance from White Sulphur Springs, paging coverage is described as poor. The Mountainview Medical Center can only communicate with ambulances within approximately seven miles of the hospital. As a result, patient information must frequently be relayed over the Sheriff's Channel. If personnel cannot communicate over their radios, they must either move to a different location, which is not always feasible or use a cell phone. Cellular coverage is poor. Consequently, units are often forced to contact a dispatcher operating on another agency's channel, such as the U.S. Forest Service, and have that dispatcher contact the Sheriff's Office by telephone to relay the communications.

3.5.2 Self Interference

Radio users are interfering with each other by operating their radios simultaneously and talking over one another. Often this is an unintended side effect resulting from the radio user being in an area where he cannot hear those with whom he is interfering. Sometimes this is caused by the radio user failing to listen to the channel to determine if it is occupied.

3.5.3 Co-Channel Interference

Other users outside the county who are legally or illegally transmitting on the same channel cause co-channel interference. Interference results in lost calls and unintelligible transmissions. While the use of tone-coded squelch reduces some of the interference, some of the co-channel users are also using the same tone squelch codes. While the use of radio frequencies is coordinated to minimize the potential for interference, tone squelch frequencies are not part of the coordination process. Meagher County receives interference from Madison County on the DES channel.

3.5.4 Congestion/Overcrowding

During emergencies, routine work must wait until the radio channel is made available. Different agencies and functions operate on the DES channel. At times there are too many conversations on the same channel. This results in excessive "wait time", when users must hold their transmissions until the channel is available. Different agencies and functions operate on the same channel. Agencies must listen to communications that do not involve them.

3.5.5 Reliability

Currently Meagher County utilizes transmitters at three different locations. There are a number of transmitters located at the Sheriff's Office in White Sulphur Springs. In addition, two remote sites are used. Public Safety Communications Systems must function under all conditions. The systems are needed the most when the conditions are the worst. The facilities housing public safety transmitters and receivers need to be maintained in good condition and capable withstanding the various environmental forces and provide protection from the elements and vermin. In addition, there needs to be appropriate levels of heating, ventilation, and air conditioning (HVAC) because of the sensitivity of the electronic equipment to fluctuations in temperature and humidity. Adequate electrical service must be provided to handle the anticipated load. Emergency power needs to be provided. Both an electric generator and an uninterruptible power supply should be provided. Fencing is strongly recommended for security purposes as are alarms.

Adequate grounding is essential to minimize the risk of the equipment damage due to electrical fluctuations and lightning. The Telecommunications Industry Association (TIA) has developed standards for grounding and bonding for telecommunications. The major radio equipment manufacturers have further refined those standards. CTA Communications has developed specifications for grounding and bonding. Both of the remote sites need considerable work to bring them up to an acceptable level of reliability. Grounding is inadequate at both sites. While there is some limited back-up battery power, neither site has an emergency generator. In the event of a power outage lasting more than several hours, the site would become inoperative.

There is currently only a very limited back-up to the dispatch facilities in White Sulphur Springs. The back up is located in the Fire Training Center adjacent to the Sheriff's Office. As noted, in 3.2.6 above, NFPA 1221 recommends that there be a back-up center capable of performing all of the functions of the primary center. It also recommends that the back-up center be located a distance away from the primary center. The Meagher County Rural Fire Department is constructing a fire station just outside of White Sulphur Springs. There are plans to locate the back-up center there.

3.5.6 Lack of Interoperability

While most of the agencies reported reasonable good interoperability due to the use of the Montana Mutual Aid Plan, the Road Department is not able to communication with Montana Department of Transportation units. Apparently, the mutual aid channels were removed from Montana DOT units in the recent past.

3.5.7 Obsolete Equipment

While the repeaters in use in Meagher County are all capable of narrowband operation, only about ten percent of the mobile and portable radios being used by the County are capable of narrowband operation. Meagher County agencies interact frequently with various federal agencies, especially the U.S. Forest Service and the Bureau of Land Management during wildfire season.

The federal agencies are under a Congressional mandate to move all of their operations to narrowband this year.

Both of the USFS and the BLM are in the final stages of narrowband implementation. Once the federal agencies complete the conversion to narrowband, the non-narrow band equipment will not be able to communicate on the federal frequencies.

3.6 Park County

This section describes the problems found by the CTA survey team in Park County. They are not listed in order of priority.

3.6.1 Coverage

There is a lack of coverage in a number of areas of the County. Most notable is the southern end of the County, south of Emigrant through Yankee Jim Canyon into Gardiner. Any communications with units in the Gardiner area or the Cooke City area must use National Park Service channels. There is no direct communication with Livingston Dispatch when the National Park Service channels are being used. The coverage issues are more severe for the Sheriff's Office than they are for the fire departments due to the fire departments having a North and South repeater and the Sheriff's Office only having a single simplex base station. Another significant problem area is the Boulder River Canyon area.

EMS units also reported many coverage issues, especially from the patient's side. With the implementation of Advanced Life Support, communications with the hospital and doctors is even more important. Those communications between the responders in the field and medical control are quite challenging. In addition, the EMS channel is not recorded nor monitored in Dispatch

3.6.2 Reliability

Public Safety Communications Systems must function under all conditions. The systems are needed the most when the conditions are the worst.

The facilities housing public safety transmitters and receivers need to be maintained in good condition and capable withstanding the various environmental forces and provide protection from the elements and vermin.

In addition, there needs to be appropriate levels of heating, ventilation, and air conditioning (HVAC) because of the sensitivity of the electronic equipment to fluctuations in temperature and humidity. Adequate electrical service must be provided to handle the anticipated load. Emergency power needs to be provided. Both an electric generator and an uninterruptible power supply should be provided. Fencing is strongly recommended for security purposes as are alarms. Adequate grounding is essential to minimize the risk of the equipment damage due to electrical fluctuations and lightning. The Telecommunications Industry Association (TIA) has developed standards for grounding and bonding for telecommunications. The major radio equipment manufacturers have further refined those standards.

CTA Communications has developed specifications for grounding and bonding. While CTA was not able to access the site at the Paradise Valley Fire Station, the two sites in Park County that we were able to survey are in need of significant effort to bring them up to standard. Neither site has an emergency power generator. While there were some batteries that may have been useable for short term backup at the North Hill Site, they were not connected. The structures at both sites are in poor condition. Bullet holes were observed in the North repeater. The door to the North Hill Site is bowed as the result of a previous lightning strike and cannot be secured. Evidence of a vermin infestation was observed at both sites. There is a lack of back-up for the transmitters. A loss of one of the sites or one of the transmitters would effectively eliminate most communications in that area.

There is a lack of back-up facilities for the dispatch center. The Park County building/Livingston City Hall is located approximately two blocks from the Montana Rail Link/BNSF main lines. Approximately 12-15 trains a day use those tracks. There is also a rail yard at the same location. Numerous rail cars carrying hazardous materials were observed during our visit. There are some limited facilities at Park County Rural Fire Station One, but that station is even closer to the railroad tracks.

The National Fire Protection Association Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (NFPA 1221) recommends that:

Each jurisdiction shall maintain an alternative communications facility that meets both of the following criteria:

(1) The facility shall be capable, when staffed, of performing the emergency functions provided at the communications center.

(2) The facility shall be separated geographically from the primary communications center at a distance from the alternative facility.

Each jurisdiction shall develop a formal plan to maintain and operate the alternative communications facility. The plan shall include the ability to reroute incoming alarm traffic and to process and retransmit emergency alarms.

3.6.3 Lack of Interoperability

While most of the agencies reported reasonable good interoperability due to the use of the Montana Mutual Aid Plan, there is no direct connection between the Livingston/Park County Dispatch Center and the Yellowstone National Park Dispatch Center. When YNP receives a call that needs to be handled by Park County, YNP writes the information out longhand and then faxes the information to Park County. In addition, when a unit is communicating with YNP Dispatch, they are not in communication with Park County. As a result any communications must be relayed by telephone from one dispatch center to the other. In addition, some fire departments report that they cannot communicate with the Sheriff's Office when they are responding to the same incident.

3.6.4 Obsolete/Incompatible Equipment

While some Park County agencies have modern equipment, several of the agencies reported using obsolete equipment.

In addition, some of the equipment has low transmitter output power which reduces the range of the radios and contributes to the coverage issues. As noted above, Park County agencies are dependent on the National Park Service in the south end of the County and on the U.S. Forest Service in other parts of the County. The federal agencies are under a Congressional mandate to move all of their operations to narrowband this year. Both of the USFS and the Park Service are in the final stages of narrowband implementation. Once the federal agencies complete the conversion to narrowband, the non-narrow band equipment will not be able to communicate on the federal frequencies.

3.6.5 Co-Channel Interference

Other users outside the county who are legally or illegally transmitting on the same channel cause co-channel interference. Interference results in lost calls and unintelligible transmissions. While the use of tone-coded squelch reduces some of the interference, some of the co-channel users are also using the same tone squelch codes. While the use of radio frequencies is coordinated to minimize the potential for interference, tone squelch frequencies are not part of the coordination process. Park County agencies reported receiving interference from the new Lewis and Clark system on several channels.

3.6.6 Self Interference

Radio users are interfering with each other by operating their radios simultaneously and talking over one another. Often this is an unintended side effect resulting from the radio user being in an area where he cannot hear those with whom he is interfering. Sometimes this is caused by the radio user failing to listen to the channel to determine if it is occupied. This is exacerbated by the fact that the Sheriff's Office does not have a repeater to relay communications between units. Instead they use the fire service repeaters which may interfere with fire communications.

3.6.7 Operational/Training Issues

Currently, the Livingston/Park County Dispatch Center does not have the ability to page multiple agencies at the same time.

As a result, often times a dispatch must be repeated up to four times. In addition, there is a lack of standard radio operating procedures and training. These problems contribute to a lack of a cohesive response especially when multiple agencies and disciplines are involved.

3.6.8 Congestion

While congestion is not a problem much of the time, when a major incident occurs, there are a limited number of tactical channels available in addition to the common Montana mutual aid channels. None of the Park County tactical channels are repeated so the range is limited on those channels especially for portable-to-portable coverage. As a result, the dispatch channel is used instead. As a result, radio traffic must wait until the channel is made available. Since there is no prioritization built in to the system, whoever keys the microphone first has control of the channel. This may cause excessive "wait time" when users must hold their transmissions until the channel is available. As the population of Park County grows, the demand for service will increase. Consistent with that growth will be an increased demand for communications.

3.6.9 Inadequate Facilities

In addition to the facility issues cited above, both the radio sites surveyed and the Livingston/Park County Dispatch Center do not have an adequate amount of space for the needed equipment. The dispatch center has two full positions. The supervisor has a desk in the corner. A private office for employee consultation or dealing with sensitive issues is not available. A traffic study was provided that showed that the dispatch center is nearing the point where three dispatchers may be required during some hours of the day. There is no room for a third dispatch position. In addition, as the equipment used in the dispatch center becomes more computer-based, there is an increasing need for equipment room space for the centralized electronics. The space available in the current center is extremely limited and inadequate.

As noted above, the two sites that CTA was able to survey in March are in poor condition. In addition to the reliability issues noted above, the buildings are crowded and not adequate for future expansion.

3.7 Sweet Grass County

This section describes the problems found by the CTA survey team in Sweet Grass County. They are not listed in order of priority.

3.7.1 Limited Coverage

There are a number of areas where voice coverage is limited or non-existent. This is especially true in the Main and West Boulder Canyon areas as well as the Bridger and Tony Creek areas.

In addition, coverage for the pagers is significantly less than two-way radio coverage. Paging is done from a different site with a lower antenna height and a lower power transmitter. There is approximately 400 feet difference in the antenna height between the two sites. Tone and voice pagers need significantly more received signal strength than a portable radio. This is because of the difference in the antennas.

Communications between the Pioneer Medical Center and the ambulances in the field are even more problematic.

3.7.2 Lack of Secure Conversations

While some limited ability to encrypt communications does exist, the scramblers are of limited effectiveness. Agencies participating in investigative or surveillance efforts must rely on unsecured channels. There is also a concern about the privacy of medical information transmitted over the radio.

3.7.3 Congestion

All Sweet Grass County agencies, except for the law enforcement units use the local government channel as their primary communications channel. During emergencies, users are forced to wait until the channel is available. Urgent communications may have to wait. There is no prioritization of traffic it is strictly a “first come, first served” basis for access.

Different agencies and functions operate on the same channel. Agencies must listen to communications that do not involve them.

3.7.4 Reliability

Public Safety Communications Systems must function under all conditions. The systems are needed the most when the conditions are the worst. The facilities housing public safety transmitters and receivers need to be maintained in good condition and capable withstanding the various environmental forces and provide protection from the elements and vermin. In addition, there needs to be appropriate levels of heating, ventilation, and air conditioning (HVAC) because of the sensitivity of the electronic equipment to fluctuations in temperature and humidity. Adequate electrical service must be provided to handle the anticipated load. Emergency power needs to be provided. Both an electric generator and an uninterruptible power supply should be provided. Fencing is strongly recommended for security purposes as are alarms. Adequate grounding is essential to minimize the risk of the equipment damage due to electrical fluctuations and lightning.

The Telecommunications Industry Association (TIA) has developed standards for grounding and bonding for telecommunications. The major radio equipment manufacturers have further refined those standards. CTA Communications has developed specifications for grounding and bonding. While the equipment shelter at the Tin Can Hill site is in fair condition and has adequate space for immediate needs, the site does not have an emergency power generator. While there were some batteries that may have been useable for short term backup, they only provide a limited amount of backup. The grounding system does not meet the recommended standards. The antenna combiner is “homemade” and is not adequate. There is a lack of back-up for the transmitters. A loss of the site or one of the transmitters would effectively eliminate most communications in that area.

The conditions at the Sweet Grass County Sheriff’s Office are not consistent with accepted industry standards meant to insure reliability and continuity of operations. The electrical system is old and poor condition. There are insufficient circuits available. Grounding is not present. The heating, ventilating and air conditions systems are old and do not provide the redundancy needed to assure continued operation.

The only air conditioning for the dispatch center is a window unit that is seasonally installed in a window between the dispatch office and an entry vestibule. That same entry vestibule is used as the equipment room for the control stations used to access the repeaters. There is no air conditioning and little ventilation in that space. In addition, there is need for substantial improvements to the physical security for both the dispatchers and the equipment. For much of the day, after normal office hours, the lone dispatcher on duty is the only person in the building. The outside entrance is locked from 9 pm until 7 pm. While the dispatcher is stationed so that she can see the entrance, it would not be difficult for someone to enter the building without being seen. In addition, the wall separating the dispatch position from the front lobby is sheet rock construction. While the window between the dispatcher and the lobby is supposedly made of bullet resistant glass, the wall is not reinforced at all.

There is also a lack of back-up facilities for the dispatch center. The Sweet Grass County Courthouse is located less than one-quarter mile from the Montana Rail Link/BNSF main lines. Approximately 12-15 trains a day use those tracks. Numerous rail cars carrying hazardous materials were observed during our visit.

The National Fire Protection Association Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (NFPA 1221) recommends that:

Each jurisdiction shall maintain an alternative communications facility that meets both of the following criteria:

(1) The facility shall be capable, when staffed, of performing the emergency functions provided at the communications center.

(2) The facility shall be separated geographically from the primary communications center at a distance from the alternative facility.

Each jurisdiction shall develop a formal plan to maintain and operate the alternative communications facility. The plan shall include the ability to reroute incoming alarm traffic and to process and retransmit emergency alarms.

3.7.5 Obsolete/Incompatible Equipment

While the repeaters in use in Sweet Grass County are all capable of narrowband operation, not all of the mobile and portable radios being used by the County are capable of narrowband operation. In addition, the programming of the radios is inconsistent. Priority channels differ between agencies and sometimes with the same agency. Sweet Grass County agencies interact frequently with various federal agencies, especially the U.S. Forest Service and the Bureau of Land Management during wildfire season. The federal agencies are under a Congressional mandate to move all of their operations to narrowband this year. Both of the USFS and the BLM are in the final stages of narrowband implementation. Once the federal agencies complete the conversion to narrowband, the non-narrow band equipment will not be able to communicate on the federal frequencies.

3.7.6 Self Interference

Radio users are interfering with each other by operating their radios simultaneously and talking over one another. Often this is an unintended side effect resulting from the radio user being in an area where he cannot hear those with whom he is interfering. Sometimes this is caused by the radio user failing to listen to the channel to determine if it is occupied. The channel used for paging is also used by the Pioneer Medical Center. In addition, the same frequency is used as the link to the Monument Repeater.

3.7.7 Operational Issues

Radio users are interfering with each other by operating their radios inappropriately or improperly. In many cases this is caused by a lack of training and by a lack of well defined standard operating procedures or guidelines.

Without responders having the methodology (planning and training), communications failures can be just as severe as those that occur because of the lack of facilities and coverage.

3.7.8 Co-Channel Interference

Other users outside the county who are legally or illegally transmitting on the same channel cause co-channel interference. Interference results in lost calls and unintelligible transmissions. While the use of tone-coded squelch reduces some of the interference, some of the co-channel users are also using the same tone squelch codes. While the use of radio frequencies is coordinated to minimize the potential for interference, tone squelch frequencies are not part of the coordination process.

3.8 Vulnerability Assessment

As described above, there are a significant number of issues that affect the ability of the various systems to function reliably under all conditions. The commercial and trade media frequently contain reports of public safety communications systems being disrupted either intentionally or unintentionally. Following is a summary of the aspects as identified above that can be considered as weaknesses in the various systems.

3.8.1 Availability

As detailed above, there are significant coverage issues in each of the five counties. This significantly limits the availability of reliable communications for public safety and public service responders in each of the counties. In addition, because of the limited number of channels used, there are significant capacity issues. This results in excessive “wait time” when users must hold their transmissions until the channel is available. It is similar to standing in line to check-out at a store. The Association of Public-Safety Communications Officials, International recommended that the average wait time not exceed five seconds. As the demand for communications increased consistent with the growth of population and the citizen expectation of service, overcrowding has become extremely serious at times especially in major metropolitan areas and will affect the ability of public safety personnel to react in emergencies.

When an unusual event, major emergency or natural disaster occurs, the demand for communications access is even greater. The capacity to meet the demand does not exist at this time. As a result critical communications may not occur either because of the lack of coverage or the lack of capacity.

3.8.2 Reliability

Our review of most of the sites used for public safety communications in the five county area has identified a significant number of issues that have a negative impact on the reliability of the various systems in use in each of the counties. There is an almost universal absence of adequate grounding. Only a few of the sites have emergency power generators. Many do not even have battery or Uninterruptible Power Supplies (UPS) to even provide short-term survivability in the event of a loss of commercial power. A number of the equipment shelters are in poor condition. The National Fire Protection Association Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (NFPA 1221) stipulates that "Wired circuits, microwave carrier channels, dedicated telephone circuits, and devices upon which transmission and receipt of alarms depend shall be monitored constantly to provide prompt warning of trouble that will impact reliability." None of the dispatch channels in the counties are monitored for integrity within the meaning of NFPA1221. This means that there is often no indication of failure.

With the exception of Gallatin County, which has a limited back-up facility at the Emergency Operating Center, none of the counties has a functional back-up for the dispatch center consistent with NFPA 1221 recommendations. NFPA 1221 recommends that the back-up center be fully functional. Two of the dispatch centers are in close proximity to railroad tracks that carry a large amount of hazardous materials. While several of the counties have an identified alternate location to move to, they are in close proximity to the primary location. Should an incident occur requiring the evacuation of the primary center, there is a high degree of likelihood that the backup center would also be in the evacuation zone as well. In addition, none of the existing dispatch centers has the capacity to add additional positions to handle the increased workload that a major incident would bring.

3.8.3 Maintainability

Just as the public safety and public service personnel are to be commended for the job they do in spite of the little that they have, the individuals who are responsible for maintaining the systems and equipment have shown tremendous initiative in making the systems function under conditions that are often less than ideal and with very limited funding. The result is a number of non-standard approaches.

While these solutions are often very effective at resolving the particular issue at hand, they often are not well documented. As a result, on-going maintenance is often dependent on the memory of the individual who created the solution. Should that individual not be available, problem resolution may be delayed or not feasible. In addition, much of the equipment being used by various agencies is old and obsolete. The equipment is no longer supported by the manufacturer. Parts are not readily available and frequently must be obtained used.

3.8.4 Survivability

With the lack of back-up facilities, adequate emergency power, and other essential elements for the continuity of operations under adverse conditions, there are serious concerns about the survivability of each of the systems in the five counties. There is at least one location in each county where a failure of that single location would cause significant disruption of communications countywide. One of the basic principles in providing for systems that function under all conditions is that there is no single point of failure. In addition there is a lack of diversity and redundancy. Often there is not a back-up for a base station on a particular channel. If that station is lost, communications are lost on the channel or in that area. In addition to the need for increased coverage, there needs to be overlapping coverage so that the effect of the loss of a single site will not have as significant an impact on operations for improved survivability of communications.

3.8.5 Security

Public facilities and systems are frequently an attractive target to those who seek to disrupt our society. There is significant vulnerability to communications disruption due to security issues Most of the remote sites have neither intrusion or fire alarms. No automatic fire suppression devices exist.

With the exception of the Bozeman/Gallatin 911 center, each of the dispatch centers also functions as the interface between walk-in traffic and the public. Limited physical security exists at these centers. Police stations and dispatch centers have been frequent targets for those bent on disrupting operations. There is a significant degree of vulnerability due to the lack of appropriate physical security measures.

TABLE 3-1

SELECTED SITES CONDITION MATRIX

Code index:
G - Good: Needs no improvements, meets CTA's construction recommendation
F - Fair: Useable, but falls short of CTA's construction recommendation
P - Poor: Needs significant improvement
N - None: Not Present
U - Unknown

NOTE:
The conditions described in this document are based on surveys by CTA in March and July 2005. Conditions may have changed since that time.

Site	County	Latitude	Longitude	Current Height	Road Access	Generator	UPS	Grounding	Shelter	Available Space in Shelter	Fencing	Utilities Connections
Andesite Mountain	Gallatin	-111.393861	45.2749167	50 ft.	G	G	G	U	G	U	N	G
Bozeman City Landfill	Gallatin	-111.02169	45.7151	16 ft.	G	N	N	P	N	P	F	G
Bozeman Fire	Gallatin	-111.03203	45.67973	80 ft.	G	G	N	N	N	P	N	G
Bridger Ridge	Gallatin	-110.92961	45.81688	28 ft.	N	SOLAR	N	P	P	P	N	G
Cinnamon Lookout Repeater	Gallatin	-111.269722	45.1311111		U	U	U	U	U	U	U	U
Crazy Repeater	Gallatin	-110.387778	46.1191667		U	U	U	U	U	U	U	U
Eagle Head	Gallatin	-111.124667	45.2243611		U	SOLAR	U	U	U	U	U	U
Fort Ellis	Gallatin	-110.9519	45.65281		U	U	U	U	U	U	U	U
Garnet Mtn. Repeater	Gallatin	-111.206111	45.4266667		U	U	U	U	U	U	U	U
High Flat	Gallatin	-111.2678	45.63766	80 ft.	P	G	G	G	G	G	N	G
Horse Butte Repeater	Gallatin	-111.1992	44.76667		U	U	U	U	U	U	U	U
Kenyon Drive Water Tank	Gallatin	-111.02525	45.66205	60 ft.	G	N	N	G	G	G	G	G

TABLE 3-1

SELECTED SITES CONDITION MATRIX

Code index:
G - Good: Needs no improvements, meets CTA's construction recommendation
F - Fair: Useable, but falls short of CTA's construction recommendation
P - Poor: Needs significant improvement
N - None: Not Present
U - Unknown

NOTE:
The conditions described in this document are based on surveys by CTA in March and July 2005. Conditions may have changed since that time.

Site	County	Latitude	Longitude	Current Height	Road Access	Generator	UPS	Grounding	Shelter	Available Space in Shelter	Fencing	Utilities Connections
Law & Justice Center	Gallatin	-111.06017	45.67383	60 ft.	G	G	G	G	N	F	G	G
Nixon Ridge	Gallatin	-111.33845	45.96544	100 ft.	F	G	G	G	G	G	G	G
Manhattan Fire	Gallatin	-111.33163	45.85571		U	U	U	U	U	U	U	U
MSU Cobleigh Hall Repeater	Gallatin	-111.04607	45.66641	70 ft.	G	N	N	F	N	G	N	G
MSU Nelson Story Tower	Gallatin	-111.05888	45.66821	120 ft.	G	N	N	F	N	P	N	G
Mt. Washburn Repeater	Gallatin	-110.432778	44.7975		U	U	U	U	U	U	U	U
Timberline	Gallatin	-110.796889	45.6482778		U	U	U	U	U	U	U	U
Trail Creek Repeater	Gallatin	-110.825	45.22		U	U	U	U	U	U	U	U
West Yellowstone Dispatch	Gallatin	-111.097444	44.65825	40 ft.	G	F	F	F	F	P	N	G
Baldy Repeater	Madison	-111.925806	45.194361	20 ft.	N	SOLAR	N	F	P	U	N	N
Lazyman Repeater	Madison	-111.858083	44.98455		U	U	U	U	U	U	U	U
Lone Mountain	Madison	-111.4502	45.278		U	U	U	U	U	U	U	U

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NOTE:
The conditions described in this document are based on surveys by CTA in March and July 2005. Conditions may have changed since that time.

Site	County	Latitude	Longitude	Current Height	Road Access	Generator	UPS	Grounding	Shelter	Available Space in Shelter	Fencing	Utilities Connections
Norris Hill Repeater	Madison	-111.64486	45.49101	50 ft.	F	N	P	P	G	G	N	G
Round Springs	Madison	-111.815	45.8502222		U	U	U	U	U	U	U	U
Ruby Repeater	Madison	-112.06986	45.09763	25 ft.	F	N	N	N	N	N	N	G
Virginia City Link	Madison	-111.95455	45.27362	38 ft.	P	N	N	P	P	P	N	G
Kings Hill	Meagher	-110.71778	46.83836	40 ft.	N	N	N	P	P	P	N	G
Martinsdale Repeater	Meagher	-110.42308	46.44345	54 ft.	N	N	N	P	P	P	N	G
Colter Repeater	Park	-109.90116	45.02806	35 ft.	G	U	U	U	P	U	N	G
Cooke City Repeater	Park	-109.94698	45.0308		P	SOLAR	N	U	P	U	N	N
Meyers Flats Repeater	Park	-110.466667	45.56666	50 ft.	F	N	N	P	P	P	N	G

TABLE 3-1

SELECTED SITES CONDITION MATRIX

Code index:
G - Good: Needs no improvements, meets CTA's construction recommendation
F - Fair: Useable, but falls short of CTA's construction recommendation
P - Poor: Needs significant improvement
N - None: Not Present
U - Unknown

NOTE:
The conditions described in this document are based on surveys by CTA in March and July 2005. Conditions may have changed since that time.

Site	County	Latitude	Longitude	Current Height	Road Access	Generator	UPS	Grounding	Shelter	Available Space in Shelter	Fencing	Utilities Connections
North Hill	Park	-110.56738	45.67392	28 ft.	F	N	N	F	P	F	N	G
North Repeater	Park	-110.67364	45.99295	35 ft.	F	N	N	P	P	P	N	G
Paradise Valley Fire Department	Park	-110.71792	45.35987	38 ft.	G	N	N	P	N	F	N	G
Sheeps Mountain	Park	-110.358333	45.7916667		U	U	U	U	U	U	U	U
Monument Repeater	Sweet Grass	-110.22559	45.20555		N	SOLAR	N	U	P	U	N	N
SO Office Courthouse	Sweet Grass	-109.95801	45.83409	38 ft.	G	U	N	P	N	P	N	G
Sweet Grass Airport	Sweet Grass	-109.97554	45.81103	50 ft.	G	F	N	P	P	P	N	G
Tin Can Hill	Sweet Grass	-109.85758	45.89445	100 ft.	G	N	N	P	G	F	N	G

4.0 FUNCTIONAL ATTRIBUTES OF THE RADIO SYSTEM

4.1 Overview of System Requirements

Once the problems and concerns of the current radio environment are understood, we can begin to define design requirements for upgraded systems. System requirements then become the basis for conceptual system design alternatives.

We began this process by assembling a list of system attributes. These are physical and operational characteristics that emphasized in the new system design. All SCMIC agencies had the opportunity to review and rank this list of system attributes. The resultant ranked list was used as a starting point to develop the alternative comparisons. In turn, the comparisons were used as a basis for developing budgetary cost estimates.

This is a feasibility study addressing the proposed alternatives: the intent is not to have a fully designed system at this point, but only to make sure that each system design concept is generally feasible, operationally appropriate, and economically sensible for SCMIC.

4.2 Target System Attributes

This section describes the target system attributes (overall functional requirements) for a radio system upgrade. SCMIC's ranking of these attributes is summarized in TABLE 4-1. The specific attributes are defined as follows:

1. Power Backup

   All fixed radio equipment shall require backup power with automatic transfer, capable of handling 100 percent loading of radio equipment. An uninterruptible power system (UPS) shall be required for computer control equipment.

2. Survivability

   The system shall be designed to survive in severe weather or emergency conditions. If dispatch points are shifted from their primary to a backup location, radio control shall be available at the backup location to the same degree it was available at primary dispatch.

3. Improved Voice Radio Coverage

The voice radio system shall provide coverage over at least 95 percent of each County's service area. The design will include in-building portable coverage where appropriate and street level coverage for mobiles. Coverage should be evenly distributed over the service area.

4. Improved Paging Coverage

The private paging system shall provide coverage over at least 95 percent of each County's service area. The design will provide coverage inside light buildings and with coverage evenly distributed over the service area.

5. Single Points of Failure

The system shall, as much as practical, minimize single points of failure. This is accomplished through redundant equipment, multiple paths, backup equipment, etc.

6. Future Expansion

The system shall be capable of future expansion in the number of channels and the number of users. System design shall incorporate expansion to the level of usage predicted for the next 10 years with only the addition of equipment.

7. Phased Implementation

As much as possible, system procurement and implementation shall occur on a phased basis, allowing costs to be staggered over several years. The radio system shall be designed to add user groups to the system over time.

8. Tiered Subscriber Cost

The initial cost of user radios is a prime concern in the evaluation of proposed alternatives. High-, mid-, and low-tier radio equipment with feature sets and costs matched to the user group shall be provided.

9. Maintainability

The radio system shall be designed for a mean-time-to-repair of not more than two hours.

10. Staffing and Training

The system vendor shall provide formal training for system administrators, supervisors, dispatchers, radio users, and maintenance technicians.

11. One System Serves All Agencies

The radio system shall support all user agencies in the five-County region including Public Safety and Public Service. Convenient, same-radio communications is important between law enforcement agencies and Public Service agencies.

12. Competitive Procurement Process

The overall system concept shall be available from more than one vendor allowing a competitive procurement process. Equipment shall be procured using open non-restrictive, competitive specifications. Award to be based on the most cost-effective system meeting the regions operational and functional requirements.

13. Multiple Sources

Compatible user equipment shall be available from multiple vendors. Competitive procurement of user equipment is more important than equipment commonality.

14. Backup Dispatch Center

Backup dispatch shall be provided at a separate location from the current dispatch center.

15. Commonality of Equipment

A single vendor shall install and supply all required equipment. As much as possible, user equipment shall be similar in operation and maintenance requirements. The goal is to minimize spare parts inventory and multiple vendor training requirements.

16. Local Flexibility

The radio system shall allow any group or department to operate with full communications capability within the five-County service area.

17. Minimize Local Interference

The system shall eliminate inter-site (co-channel), and local bleed-over interference.

18. Centralized Maintenance

The region prefers to centrally maintain and administer the radio system and user radios, either in-house or using a service shop. Centralized maintenance provides consistent and coordinated services for all user departments.

19 Alert Monitoring

The alerting procedure and equipment shall provide a means for the respondent group members to monitor progress of the response.

20. Emergency Access

The radios and system shall provide an emergency function for alerting dispatch and supervisors to the need for assistance.

21. State Connectivity

The system shall provide connectivity to other phases of the State of Montana Public Safety Radio Project, particularly adjacent areas.

22. State Flexibility

The radio system shall maximize user equipment interoperability for departments needing to operate elsewhere within the State.

23. Microwave Connectivity

The system design shall include a microwave network to carry radio traffic and other information. The network would be expandable to ultimately interconnect all major population centers with the five-county region.

24. Owner-Controlled Backbone

The system shall be interconnected using dedicated microwave and other technologies. The goal is to minimize use of leased carriers and associated costs, and maintain control of the network.

25. Operational Boundary Transparency

The radio system shall transmit/receive from multiple sites, with switching operations transparent to the radio user. System operation shall be logical, with the focus on who the user wants to call rather than where they are located.

26. Increased Channel Capacity

The system shall add channels to alleviate contention for repeated TAC channels and simplex channels.

27. Mobile Data

The system shall be designed to support increased usage of mobile data by additional agencies in the future. The primary functions of mobile data are CAD dispatches, field reports, and records queries.

28. Dispatch Capacity

The dispatch system shall provide consoles for existing dispatcher positions, plus one additional console, plus one supervisor/overflow/training position, plus space for one future growth position.

29. Two-Way Paging

The private paging system and pagers shall be upgraded to two-way paging technology.

30. Voice Security

The system shall provide encrypted communications for users that need to prevent unauthorized interception of sensitive information.

31. Workgroup Oriented Operation

The system shall be organized with sufficient channels or talk groups to allow departmental workgroups to have their own channel or talk group.

32. Fire Station Printouts

The dispatch system shall provide a means of printing a hardcopy of the incident information at selected rural fire stations.

33. Increased Dispatch Channel Capacity

The system shall alleviate congestion on the dispatch channels through the addition of channels or reallocation of the existing channels.

34. Paging over Cellular

The private paging system shall include alternate means of delivering a page such as over commercial cellular service to a cell phone or PDA device.

35. Regional CAD Operation

The system shall extend operator positions on the Gallatin County CAD system to other dispatch locations to 1) extend use of the existing CAD system, and 2) improve information sharing between centers.

36. Internet Paging

The private paging system shall include alternate means of submitting a page request such as via email or over the Internet.

4.3 System Design Goals

First, a radio system must be designed to address *routine* operations. Designing the system to operate at about 30% capacity for typical routine operations will ensure calls connect with no delay and that there is adequate room for growth.

Second, the radio system must be able to handle day-to-day peak operations. These peaks will occur at various times of day depending on location within the five-county region. In Bozeman, peaks will typically occur around shift change. In smaller towns and rural/residential areas, the peaks usually happen early morning and late afternoon when people are driving. The system operates from 65-90% of capacity. The system should provide connection for all calls with no delay.

A third, and we consider equal, design goal is to address *emergency* operations. Here we consider the inevitable unplanned, unrehearsed responses to catastrophic conditions, responses that at best are harried and at worst become chaotic. The major operational end products in the *emergency* mode of operation are:

- Safety of citizens and property
- Safety of emergency responder personnel and property
- Efficient and effective return of the situation to routine steady-state conditions
- Mutual Aid to the surrounding communities

During emergency operations, there should be no major changes in the standard operating procedures used in routine operations. Since the nature of emergency operations is inherently unusual, the personnel involved will naturally rely on methods of communications that they are familiar with. The difference between routine and emergency communications should come down to only an increase in the number of calls on the system.

We therefore consider that any two-way radio system infrastructure developed for the consortium region must have sufficient capacity to handle the increased communications load during emergencies.

4.4 Communications Scenarios

Two basic scenarios require addressing in the design of a radio system.

- Normal operation within the coverage area
- Mutual Aid outside the coverage area

Each scenario will be briefly discussed in the following paragraphs and will be addressed as related to each proposed solution in its appropriate section.

4.4.1 Communications within the Coverage Area

This scenario includes all communications within the boundaries of the five-county consortium coverage area as previously defined. This requirement includes in-building portable coverage and mobile coverage throughout the area. The system shall be designed to provide communications point to point anywhere within the entire coverage area for both portable and mobile radios. For example, a local Sheriff's deputy in West Yellowstone or Big Sky shall have communications with the Sheriff's office in Bozeman. The same wide area communications is needed for each of the five counties. The goal is to provide radio coverage where it is needed in the region with both tactical channels and access to the appropriate county dispatch center.

4.4.2 Mutual Aid Communications in the Surrounding Jurisdictions

The overall communications plan and the technology employed shall fit into the State of Montana Statewide Public Safety Radio Communications Plan. That is to say, that radio and communications procedures that work in the SCMIC consortium area will also work in other regions of the state, and visa-versa. This is because the SCMIC architecture is designed from the beginning with statewide requirements and compatibility in mind. The SCMIC region enjoys a very high level of agency interoperability now, and the plan is to build upon that success with further enhancements. The intent of the enhancements is to facilitate the ability of units from the SCMIC region to roam into other jurisdictions and units from other regions to roam into the SCMIC region with minimal operational limitations.

Table 4-1 SCMIC
SYSTEM ATTRIBUTE RANKING

ATTRIBUTE		RANK
28	Power Backup	4.7
26	Survivability	4.7
1	Improve Voice Radio Coverage	4.7
2	Improve Paging Coverage	4.5
27	Single Points of Failure	4.4
22	Future Expansion	4.3
35	Phased Implementation	4.3
36	Tiered Subscriber Cost	4.2
30	Maintainability	4.2
34	Multiple Sources	4.0
29	Staffing and Training	4.0
32	Competitive Procurement Process	3.9
24	State Connectivity	3.7
23	Microwave Connectivity	3.6
33	Commonality of Equipment	3.6
25	Owner-Controlled Backbone	3.5
18	Alert Monitoring	3.5
12	One System Serves All Agencies	3.4
31	Centralized Maintenance	3.3
6	Emergency Access	3.3
3	Minimize Local Interference	3.1
14	Backup Dispatch Center	3.1
13	Dispatch Capacity	3.1
11	Operational Boundary Transparency	3.0
5	Increased Channel Capacity	3.0
17	Mobile Data	3.0
10	State Flexibility	2.9
9	Local Flexibility	2.9
20	Paging over Cellular	2.8
16	Fire Station Printouts	2.8
8	Voice Security	2.8
7	Workgroup Oriented Operation	2.6
21	Two-Way Paging	2.5
4	Increased Dispatch Channel Capacity	2.5
15	Regional CAD Operation	2.1
19	Internet Paging	1.8

Ranking Scale:
0 - Attribute is NOT IMPORTANT to the user.
1 - Attribute is MINIMALLY IMPORTANT to the user.
2 - Attribute is NICE TO HAVE, could enhance operations.
3 - Attribute is USEFUL, will promote more efficient day to day operation.
4 - QUITE IMPORTANT, lack could result in degradation of mission, injury, or loss of property.
5 - CRITICAL, lack generally will result in injury, loss of property, or degradation of mission.

5.0 ANALYSIS OF ALTERNATIVES

A major step in the interoperability design process was to identify alternative communications solutions that would satisfy the majority of the SCMIC region's requirements. After these solutions were identified, we analyzed each alternative in the context of SCMIC's requirements. In this section, we summarize each alternative and list the advantages and disadvantages.

5.1 Communications Alternatives

CTA Communications has investigated various alternatives to improve the existing SCMIC community radio environment. Each alternative was considered according to its ability to meet the requirements of SCMIC. The following alternatives were considered.

A. Do Nothing – This alternative has traditionally been an option for some communities. The fluctuating state of technology often leads communities to feel that waiting for the next series of technology improvements before purchasing is the best choice. Communities do not wish to make significant financial errors. There is also the economic relief of not immediately purchasing new equipment. This is essentially the position that the SCMIC community has taken over recent years. This alternative is not an option for SCMIC. The SCMIC community has grown to the point where a technical upgrade is required to continue providing the expected levels of law enforcement and fire services. Pending Federal regulations, and technical advancements in adjacent regions will soon hamper SCMIC's ability to communicate interoperate in the region. This alternative is in fact counter productive and does not provide a foundation for progressing to more advanced options.

This alternative provides no improvement to the most serious problems with the present system. It does not improve coverage, and does not improve existing subscriber units. No action would be taken until forced off the existing channels by FCC action. The following is a summary of advantages and disadvantages:

Advantages:

1. No expenditure of funds.
2. Does not require replacement of existing subscriber units.

3. No learning curve - operation remains unchanged.

Disadvantages:

1. Does not provide improvement
2. Does not allow continued communications with USFS and other agencies converting to new technologies.
3. Does not prepare community for future changes.
4. Not a proactive stance on Federal Narrowbanding mandate

B. FCC Compliance Only – Federal regulation through the actions of the FCC's narrow-banding efforts has created an environment where change is mandated. The FCC is taking steps to increase the available radio spectrum by narrow-banding the use of radio frequencies. This effort essentially requires the replacement of all radio equipment with narrow-band capable units. While spectrum shortages are not an acute problem for SCMIC, critical bordering agencies are proactively making the needed changes. In the short term, SCMIC looses radio compatibility with Federal agencies and as deadlines draw near, will be caught in a compliance scramble. This alternative would involve replacing only the equipment that is necessary to meet the federal mandates. The non-fixed units (mobiles and portables) and the transmitters would be replaced with narrow-band capable units. This alternative will not add sites or improve reliability of the sites. Except for the new units, this alternative does not significantly advance SCMIC's communications environment. For additional background on Narrowbanding and P.25, please see APPENDIX A.

This alternative improves the subscriber units and basic transmitters in use by replacing them with narrow band capable and P.25 capable units. No effort is made to improve coverage. This is the minimum alternative permissible under FCC regulations.

The following summarize the advantages and disadvantages of this alternative:

Advantages:

1. Meets minimum regulatory requirements
2. No site expenditures
3. Does allow continued communications with USFS and other agencies converting to new technologies

4. System operation remains unchanged
5. Additional channels available to SCMIC now due to Narrowbanding
6. Lower cost

Disadvantages:

1. Requires replacement of all most of the subscriber fleet and many pieces of infrastructure equipment
2. Coverage is not improved
3. Does not prepare community for future changes.

C. Fix Infrastructure - A less aggressive approach would be to improve the existing radio infrastructure. This alternative primarily improves system reliability and performance of the existing channel and site configuration. Some marginal coverage improvements may be realized due to optimization and refurbishments of antenna systems. But no additional sites or channels are part of this option. System availability would be increased with added backup power systems. The technologies used in this alternative would remain the same; conventional analog base stations and repeaters. The physical facilities including some antenna systems, some shelters, grounding, back-up power, and other such improvements will make be improved making the systems more robust.

This alternative results in no feature and limited operational improvements. Worse yet, while the effort improves things locally, you begin to fall behind in interoperability with your surrounding consortia. All indications are that other regions plan to add P.25 technology to their analog operations in a coordinated statewide fashion. In the final analysis, this option appears to us as spending most of the money, but in spite of that, missing most of the benefits. For example, four of the top ten system attributes relating to coverage, design, and future expansion in TABLE 4-1 are not addressed. There are better approaches that will move you in the direction of more advanced technologies, improve the operating environment, and demonstrate cooperation with the State. Additional background on conventional radio systems is contained in APPENDIX A.

This alternative refits the existing sites with the design of improving the coverage of the radio environment.

The advantages and disadvantages of this alternative are as follows:

Advantages:

1. Meets minimum regulatory requirements
2. Does allow continued communications with USFS and other agencies converting to new technologies
3. System operation remains unchanged
4. Some spectrum efficiency may be achieved via narrow -banding
5. System remains under the control of the SCMIC community
6. Improves reliability by providing site redundancy.
7. Medium cost

Disadvantages:

1. Requires replacement of most of the subscriber fleet
2. Requires significant repairs of infrastructure, towers, site facilities
3. Coverage is not improved
4. Adds no significant system improvements

D. <u>Improve Infrastructure</u> – This alternative provides for all the physical facility improvements that are described in the "Fix Infrastructure" alternative above. In addition, it improves operational capabilities with new channels where needed, added sites where coverage is short, and relocated sites where cost/coverage tradeoffs are sensible. The utilization of the existing channels may be changed as well. This is the first alternative that prepares the region to move forward into a better system.

The technologies applied in this alternative are conventional signaling, analog and P.25 digital repeaters and station, voted receivers, transmitter steering, and simulcast paging. This will provide a strong addition to the reliability of the regions radio systems. This alternative provides for the growth and expansion ability for the future. Additional background on voted receivers, transmitter steering, and simulcast is contained in APPENDIX A.

As SCMIC envisions future growth and seeks to plan a logical progression toward trunked technology, it makes sense to complete this alternative in preparation for that goal.

All of the physical site improvements and most of the LMR infrastructure recommended as part of this alternative is upgradeable to trunking technology. As vendors strive for component commonality between trunked and conventional base stations, the idea is that with the additional of trunking controllers, and substitution of trunking-specific modules. The remaining trunked alternatives are dependent on this solution having been completed first.

This alternative includes adding sites and refitting some of the existing sites with the design of improving the coverage of the radio environment. The advantages and disadvantages of this alternative are as follows:

Advantages:

1. Prepares the community to move forward with other improvements
2. Coverage is designed for the community
3. System remains under the control of the SCMIC Community
4. Improves reliability by providing site redundancy
5. Some spectrum efficiency may be achieved via narrow –banding
6. Adds significant system improvements

Disadvantages:

1. Requires mostly new infrastructure, towers, site facilities
2. Higher cost

E. <u>Join the State Trunked System</u> -This alternative involves the region joining as a full participant the new State Trunking system. The region would provide local trunking infrastructure and subscriber radios, while the State would provide the trunking system controls and the console operation interfaces. In this alternative the requisite SCMIC region microwave network becomes and integral part of the State microwave network. We envision the logical connection point between the SCMIC microwave system and the State network as through a site in Broadwater County. This alternative will also require an involved level of interconnectivity between all of the regions members and the State system. Additional background on trunking radio systems is contained in APPENDIX A.

The usual driver for going to the significant additional expense and complexity of trunking technology is traffic loading, scarcity of radio spectrum (licensable channels), and the strong need for maximum spectrum efficiency.

As we will discuss later in this report, crowded and congested channels was not a significantly reported problem. In fact, the only system attributes relating to channel crowding ranked by SCMIC users in the bottom 1/3 of the list in TABLE 4-1.

The State plans on creating a statewide trunked radio system, expanding out from the initial system in the Helena area. The system could be expanded into the SCMIC area. At that time the SCMIC Consortium members could join the state network. The state would provide the central system control for the system and console operations.

Advantages:

1. Easy operation in other trunked regions
2. Improved trunking system feature set
3. Best option for spectrum efficiency

Disadvantages:

1. Requires trunking controls added to sites
2. Requires use of high-cost trunking subscriber units
3. More difficult transition, higher learning curve
4. Region not totally in control of system and operating parameters
5. High cost

F. Create SCMIC Trunked System - In this alternative the region would create its own trunked radio system, separate from the State system. All ownership and control would be under the SCMIC region; and all of the costs would be born by the region.

Here the SCMIC region would create its own trunked radio system, free standing from any others.

Advantages:

1. SCMIC retains control of their system
2. Improved trunking system feature set
3. Some spectrum efficiency may be achieved in the region

Disadvantages:

1. Requires trunking controls for system.
2. Requires use of high-cost trunking subscriber units.
3. More difficult transition, higher learning curve
4. Highest costs

5.2 Alternative System Analysis

Throughout the members of the SCMIC region there are several communications problem areas. The major concerns that exist in all communities are:

- Limited Coverage
- Site Reliability
- Narrow-band capabilities
- Added Channels

When we compare the alternatives to their affect on the core problem areas there are several features that stand out. The "Do Nothing" alternative does not approach solving any of the regions problems. In fact due to the regulatory environment this would actually be stepping backwards. The FCC Compliance alternative has the advantage of keeping the operations of the region within regulation. However, only one of the factors above, "Narrow-band capabilities," is addressed. The "Fix Infrastructure" creates some improvement in reliability and functioning, however it does not provide for the needed infrastructure base improvements and has little effect on coverage deficiencies. The first and least expensive, alternative that addresses each of these core concerns is “Improve Infrastructure ". Joining the State Trunking System and a SCMIC owned trunked system will answer all of the concerns if it is implemented correctly with the sites positioned to provide coverage. TABLE 5-1 summarizes the possible improvements.

TABLE 5-1
ALTERNATIVES

PROBLEM	Do Nothing	FCC Compliance	Improved Coverage	Join State Trunked System	Create SCMIC Trunked System
Limited Coverage			X	X	X
Site Reliability			X	X	X
Narrow Band Capabilities		X	X	X	X
Added Channels			X	X	X

6.0 REGULATORY ISSUES

The following significant regulatory or standards-related issues will impact the planning of a land mobile radio (LMR) system:

- Migration to Digital Technology
- Narrowbanding of LMR Frequencies below 512 MHz
- The 4.9-GHz Band

Each of these issues will directly affect the technology that will be available to SCMIC.

6.1 Migration to Digital Technology

The migration to digital modulation technology is not, strictly speaking, a regulatory issue. The Federal Communications Commission (FCC) has not mandated the use of digital modulation in any LMR band except for the new 700-MHz public safety band. However, digital modulation has been encouraged by several regulatory proceedings. This migration is driven by several factors:

- Rapid growth of wireless communications technologies and services, which has created an increased demand for radio frequency (RF) spectrum
- The need for improved security of voice communications
- The need to transfer more and more varieties of data
- The availability of increased computing power for mobile and portable radio equipment.

For decades, LMR systems have utilized analog FM voice technology. More recently, the major vendors of trunked radio systems have offered dual-mode systems, supporting both analog and digital modulation. In 2004, the largest trunked radio system manufacturer, Motorola, announced it would stop shipping new dual-mode radio systems in favor of its all-digital product line. Motorola's largest competitor, M/A-COM, still continues to offer dual-mode systems. Most conventional radio systems are still analog, but digital systems are increasing in number.

6.1.1 Digital Communications Techniques

One of the primary advantages of digital communications is the ability to improve spectrum efficiency by increasing the number of communication paths or circuits per RF bandwidth. In LMR systems, there are two main techniques for accomplishing this: frequency-division multiple access (FDMA) and time-division multiple access (TDMA).

In an FDMA system, spectrum efficiency is improved by dividing the existing RF channel into two (or more) narrower channels with one voice channel for each RF channel. In a TDMA system, spectrum efficiency is improved by dividing the channel into two or more time slots with one voice channel per time slot. For example, most existing stations in the VHF and UHF bands operate on 25-kHz channels. Under the FCC's narrowbanding plan, licensees can either convert their systems to operate in 12.5-kHz channels (the FDMA solution) or continue to use a two-slot TDMA solution in 25-kHz channels. In either case, the spectrum efficiency mandate is achieved by creating two voice channels per 25 kHz of spectrum instead of one.

6.1.2 Advantages of Digital Technology

Increased Capacity

As explained above, the main potential advantage of digital technology is the increased capacity generated by improved spectrum efficiency. Creating two or four voice channels per 25 kHz of spectrum doubles or quadruples capacity.

Signal Recovery

An analog repeater simply retransmits the signal it receives (along with noise and interference), while a digital repeater performs error correction on the received signal and retransmits it, removing noise and interference in the process.

A similar process takes place in the mobile or portable radio. The subscriber unit performs error correction on the received signal, providing better audio quality in weak-signal areas at the fringes of the coverage area.

The drawback to this is that, to the user, there is no sense of signal degradation at the fringes. Audio simply disappears suddenly at the limits of radio coverage. Conversely, analog voice quality experiences a gradual degradation as the user approaches the fringes of the coverage area and thus provides the user some warning that they may soon be out of range.

Encryption

Although analog encryption schemes are still available for conventional radio systems, trunked radio system vendors only offer digital encryption. Digital encryption is more secure than analog encryption and does not reduce understandability as older methods did.

Even without encryption, digital systems provide some protection against casual eavesdropping because most scanners cannot decode digital signals. However, because there are digital scanners capable of decoding digital radio systems, encryption is the only way to ensure security.

6.1.2.1 Mobile Data

Digital modulation schemes offer the potential for improvements in data rates for mobile data applications. Currently, most LMR vendors offer a data rate of 19.2 kbps per 25-kHz channel. This meets the FCC regulatory requirements for narrowbanding in the VHF and UHF bands and for the new narrowband channels in the 700-MHz public safety band. However, we believe that significant increases are possible in the future.

Most attention is now focused on the wideband channels in the 700-MHz band and the new 4.9-GHz public safety band. The FCC has mandated data rates of 384 kbps per 150-kHz channel in the 700-MHz band. The 4.9-GHz band is allocated especially for wideband data transfer. The channel plan is designed for commercial data standards like IEEE 802.11.

The major LMR vendors are busy preparing products for these bands. The market for these products is new, so it will be a while before mature product lines are widely available.

6.1.3 Disadvantages of Digital Technology

6.1.3.1 Cost

The costs associated with digital technology have been significantly higher than with analog technology. However, digital equipment prices continue to drop. We expect that eventually the difference in price between analog and digital systems will no longer be an issue. At the present time, digital infrastructure equipment like repeaters and voters is about ten percent more expensive than comparable analog or dual-mode equipment, while digital subscribers can be 30 to 50 percent more expensive than analog subscriber units.

6.1.3.2 Interoperability

Interoperability remains a challenge for everyone, but especially for digital radio systems. Consider the following:

- Analog conventional radio systems offer true over-the-air compatibility—unless the systems are in different frequency bands.
- Trunked radio systems from different vendors do not provide over-the-air compatibility with neighboring systems. In order to provide communications between dissimilar systems, radio vendors must provide patches or other fixes that allow users to talk with each other on an as-needed basis. The alternative is to specify direct over-the-air compatibility with neighboring systems, which typically results in a sole-source procurement.
- Even trunked radio systems from the same vendor may not be able to communicate with each other. New subscribers may be able to communicate on older systems, but the older subscriber units may not work on the new systems. This provides "halfway" compatibility.

- Digital radio systems have an inherent latency—the time it takes to translate an analog voice signal into a digital format and then translate it back to analog voice at the receiver. This latency can be minimized within a single radio system, but when two systems are patched together, the analog-to-digital-to-analog conversion is performed twice rather than once, doubling overall latency and causing greater difficulty for field personnel.

These problems continue to make interoperability with adjacent jurisdictions using diverse systems and frequency bands a serious technical and operational challenge.

6.1.4 Project 25

The Association of Public-Safety Communications Officials International (APCO), in conjunction with the Telecommunications Industry Association (TIA) and others, initiated APCO Project 25 (P25) to promote a single non-proprietary set of standards for digital radio communications. The purpose of the standards was two-fold:

- To improve interoperability between law enforcement agencies; and
- To provide greater competition and cost savings in the procurement of radio equipment.

The P25 standards are being developed in three phases. Phase I, designated ANSI/TIA/EIA-102, is an FDMA technology based on one voice or data channel per 12.5-kHz RF channel. The Phase I standards are nearly complete. When vendors speak of P25 compatibility, Phase I is usually what they are talking about.

Phase II, still in the early stages of development, has several goals. One goal is to define technology standards that will provide one voice channel per 6.25 kHz of spectrum. It will accomplish this by taking a two-pronged approach: an FDMA standard based on a 6.25-kHz RF channels and TDMA standards based on a four-slot 25-kHz channel or a two-slot 12.5-kHz channel. The standard requires that any Phase II equipment must be backward-compatible to communicate in Project 25 Phase I mode.

Phase II will also define IP-based interconnection standards for infrastructure equipment such as repeaters, controllers and consoles. As it stands now in Phase I, subscriber equipment from a variety of manufacturers can be mixed, but infrastructure equipment, such as repeaters, controllers and consoles, cannot. Once you purchase infrastructure equipment from a single manufacturer, you are locked in to that manufacturer for system upgrades or expansion.

Phase III, also known as Project 25/34, defines the requirements for wideband high-speed data standards. Work on these standards has continued under the auspices of Project MESA, a combined effort of the Project 25 Group and a European group. This effort has produced TIA-902, a wideband data standard which the FCC has proposed for use on the wideband interoperability channels in the 700-MHz band.

6.1.5 TSB88

Prior to the development of digital modulation technologies, analog radio systems were designed based on a large body of empirical knowledge. Engineers were able to draw upon years of collective experience in the propagation characteristics of analog radio systems, translating acceptable communications to signal level targets. This is not the case with the new digital technologies.

In the case of digital technologies, each modulation technique may have different characteristics, and each vendor's product may have different error correction capabilities. Because of this, very little information has been published on digital propagation outside of information published by vendors on their unique products and coverage philosophies.

In an effort to fill the need for a common reference point in the field of digital radio propagation, the Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA) released Telecommunications Systems Bulletin 88 (TSB88), *Wireless Communications Systems - Performance in Noise and Interference-Limited Situations -Recommended Methods for Technology-Independent Modeling, Simulation, and Verification*. Although not a true regulatory (FCC-inspired) action, TSB88 and its latest revisions have already had an impact on the design of two-way radio systems.

TSB88 is a beginning step, or basic guideline, for defining and predicting digital/narrowband propagation. It defines many of the elements of radio system coverage in common terms. There are sections devoted to service area, testing methodology, propagation models, reliability, noise and frequency coordination. It is not a standard, but has achieved "quasi-standard" status in that no other document or statement on the subject exists. Once there is more experience in actual field performance of digital systems, these lessons can be applied to the provisions of TSB88.

The design of any radio system involves a certain degree of risk. As the vendor's engineers approach the project, they must account for this risk factor in the overall system design. A system designed with an overly optimistic propagation model runs the risk of not meeting the coverage requirements of the purchaser. A design that is overly conservative can reduce this risk to negligible levels, but the price of the system may be exorbitant.

The latest revision of TSB88, TSB88-B, takes a very conservative approach to radio propagation and system design. This encourages a design that provides reduced risk for the vendor but possibly higher expense for the customer.

CTA recommends and will assist SCMIC in designing a radio system considering the provisions of TSB88-B. However, designing the system to meet all of the actual and implied recommendations of TSB88-B may lead to an overdesigned system and excessive costs. Because of its "quasi-standard" status, the issue of TSB88 "compliance" will be an issue in any liability or conflict situation. We recommend that TSB88-B be taken into *consideration* during the design of SCMIC radio systems but that the provisions of TSB88-B be applied appropriately to the unique needs of SCMIC.

6.2 Narrowbanding of Land Mobile Radio (LMR) Spectrum below 512 MHz

The FCC began in 1992 a proceeding to increase spectrum efficiency in the Private Land Mobile Radio (PLMR) bands below 512 MHz. The "Refarming Proceeding", as it became known, introduced major changes in these bands.

6.2.1 New Narrowband Channels

The FCC created new narrowband channels in the 150-174 (VHF High), 421-430, 450-470 and 470-512 MHz (UHF) bands.

In the VHF high band, where existing 25-kHz (wideband) channels were spaced at 15 kHz, new narrowband channels were created 7.5 kHz from existing channels. The new channels may only be licensed for bandwidths of 12.5 kHz or less.

In the UHF bands, where existing 25-kHz channels were spaced 25 kHz apart, new channels were created at 12.5 kHz and 6.25 kHz from existing channels. The channels 12.5 kHz from existing channels are available for licensing at 12.5-kHz or less bandwidths and those 6.25 kHz from existing channels are available for licensing at 6.25-kHz or less bandwidths.

The new channels are available for licensing now. However, incumbents are still operating at the old 25-kHz bandwidths on adjacent channels, creating the potential for interference to the new channels.

6.2.2 Narrowband Equipment Requirements

All new LMR equipment placed on the market today must be capable of operating at a spectrum efficiency of one voice channel per 12.5 kHz of channel bandwidth. This can be accomplished by using either FDMA technology, transmitting a single voice channel in 12.5-kHz RF channel, or TDMA technology, transmitting two voice channels in a 25-kHz RF channel. (For data transmitting equipment, the efficiency standard is 4800 bps per 6.25-kHz of channel bandwidth.)

The FCC's ultimate goal is one voice channel per 6.25-kHz channel, but the FCC has stayed the deadline for meeting this requirement as it considers the state of technology and narrowband migration.

Although new equipment must be capable of operating in more efficient modes, licensees are still allowed to operate this equipment at the old wideband efficiency standard of one voice channel per 25 kHz of channel bandwidth.

At the time these rules were adopted, the FCC believed that the congested conditions in the refarming bands would provide a "natural inducement" for users to migrate to narrowband equipment. However, since the rules were enacted, very few incumbents have migrated to the narrower bandwidths, so the FCC has reconsidered its decision that the migration be wholly voluntary.

6.2.3 Deadline for Wideband Equipment Manufacture

Recently, the FCC decided to set deadlines for migration to greater spectrum efficiency. As a result, the FCC decided to prohibit manufacture and importation of equipment capable of operating at one voice channel per 25 kHz of bandwidth after January 1, 2011.

6.2.4 Deadline for Migration

The FCC also updated the rules to set a fixed deadline for all users to transition to 12.5 kHz operation. The deadline for conversion to 12.5 kHz efficiency is January 1, 2013 for all licensees. After that date, all licensees in the bands 150-512 MHz must operate at a spectrum efficiency of one voice channel per 12.5 kHz of bandwidth. Users may still use 25 kHz channels as long as the spectrum efficiency standard is met.

The FCC has not yet set a deadline for conversion to 6.25 kHz efficiency.

6.2.5 Deadline for Wideband Applications

At the same time, the FCC set January 1, 2011 as the deadline for applications for new wideband licenses and modifications to existing wideband licenses. This allows users flexibility to maintain and expand existing systems until two years before the migration deadline.

6.2.6 Trunking in the VHF and UHF Bands

As part of the Refarming Proceeding, the FCC established rules for trunking in the 150-174 and 450-470 MHz bands. The rules allow trunking as long as concurrence is obtained from affected licensees within 70 miles of the proposed trunked station. The term "affected licensees" refers to stations with assigned frequencies 15 kHz or less from a proposed trunked station with 25-kHz bandwidth, 7.5 kHz or less from a proposed trunked station with 12.5-kHz bandwidth and 3.75 kHz or less from a proposed trunked station with 6.25-kHz bandwidth. In lieu of concurrence, an applicant may provide an engineering study that demonstrates that the proposed station interference contour does not overlap the affected licensee's service territory. Rules for trunking below 512 MHz require so much coordination with neighboring licensees that they make the implementation of trunking systems in these bands quite difficult.

6.2.7 Impact of Narrowbanding on SCMIC's Communications

With its decision to set deadlines for the transition to 12.5-kHz operation, the FCC has provided much-needed clarity to the narrowbanding issue. SCMIC may legally continue to operate its existing 25-kHz VHF and UHF systems until 2013, but will eventually face a reduction in bandwidth, which will result in a reduction in coverage. The FCC's decision provides sufficient time to plan for the transition.

If SCMIC's existing wideband radio systems are adequate, it may make sense to maintain it as is until the transition date is closer. However, major new investments in equipment should be based on more spectrum efficient technologies.

6.3 The 4.9 GHz Band

6.3.1 Band Plan

In 2003, the FCC established rules for the 4.9 GHz Public Safety Band. The band is divided into 18 channels with bandwidths of 1 or 5 MHz.

The purpose of this band is primarily to provide public safety users with spectrum for broadband communications applications. The spectrum can be used for data, voice, video, wireless local area networks, or any number of high-speed digital technologies. It is intended for mobile use, while temporary fixed use is allowed. The FCC envisions this band's use for the implementation of incident scene networks and wireless "hot spots" for high-speed data transfers of things like maps, building layouts, emergency medical service files, and wanted or missing person images.

Recently, changes were made to the rules for the 4.9 GHz band in order to allow the use of the IEEE 802.11 (Wi-Fi) series of standards. It is hoped that this will make available a wider range of products for use in the band and will leverage the economies of scale to lower equipment prices.

6.3.2 Licensing and Coordination

A license will be issued to any public safety entity, and allow the entity to operate base, mobile or temporary fixed units throughout its legal jurisdictional area of operation. Applications must be made directly to the FCC; there is no frequency coordination necessary and no fees. Permanent, fixed, point-to-point services are allowed on a secondary, non-interfering basis, but require a separate site license.

The spectrum is licensed on a shared basis, i.e., all users are licensed to all channels. Licensees must coordinate with each other to use the band. The FCC gave 700 MHz regional planning committees the option to establish regional plans for the use of the 4.9 GHz spectrum. Since the availability of the band and the development technologies to use it are so recent, the FCC agreed to give the planning committees extended time to prepare plans for the coordinated use of the band.

We encourage each county in the SCMIC to apply for a 4.9 GHz license. There are no deadlines to implementing a system. This band may eventually provide SCMIC an opportunity to implement an inexpensive high-speed mobile data network.

7.0 REGIONAL INTEROPERABILITY DESIGN

Any significant public safety incident will require the response of more than one public safety agency. The more significant the incident, the number of responders and agencies will become larger. Anytime there is more than one responder to an incident, there is a need to coordinate. Without effective communications, the ability to coordinate is severely limited. The ability of personnel from one public safety agency to communicate with personnel from another public safety agency is a critical, well-documented essential need that is frequently not met when an incident occurs not only in the South Central Montana Interoperability Consortium Area, but also in many areas of the nation. This is referred to as Interoperability.

The Public Safety Wireless Network (PSWN) program (a joint initiative of the U.S. Departments of Justice and the Treasury), which is now part of the SAFECOM program, has identified three types of interoperability:

- *Day-to-day interoperability* covers routine public safety operations, such as responding to a building fire that requires backup from a neighboring fire department, or a vehicle chase that crosses between towns.

- *Mutual aid interoperability* supports a joint and immediate response to catastrophic accidents, large scale incidents and natural disasters. It supports tactical communications in response to airplane crashes, bombings, forest fires, earthquakes, hurricanes and similar events that occur without warning.

- *Task force interoperability* supports local, state, and federal agencies collaborating for an extended period of time to address a particular problem. For example, a task force might lead extended recovery operations, provide security for major events, or respond to prolonged criminal activity. These are activities that are planned in advance.

The Department of Homeland Security and the Association of Public Safety Communications Officials, International have defined six methods to achieve interoperability. These include:

1. Swapping Radios
2. Talk Around/Shared Channels
3. Mutual Aid Channels

4. Gateway/console patch
5. System-Specific Roaming
6. Standards-based Shared System

Because of the widespread use of the VHF High-band spectrum, interoperability in the region has generally moved beyond Level 1 swapping radios although there may always be some need for this when dealing with responders from out of the region such as from Idaho and Wyoming. Talk around occurs frequently when users from one system operate on another system. Perhaps the most frequent example of this is when SCMIC units switch to either US Park Service or Forest Service channels to communicate with Park Service or Forest Service personnel. Because most of the agencies in the SCMIC area operate in the same frequency band as federal government agencies in the area, there is a much higher degree of interoperability in the region than in many other parts of the country since many local users are able to switch to (roam) the appropriate federal government channels. Through the *Montana Mutual Aid and Common Frequencies Plan* agencies in the South Central Montana Interoperability Consortium have access to a number of common mutual aid channels that are used statewide in Montana. Because of the widespread availability of the mutual aid and common frequencies, little use has been made of gateways or console patches. The SCMIC may wish to consider obtaining a transportable gateway, such as the ACU-1000 to be staged in the event a large scale incident occurred necessitating the response of significant numbers of responders from outside of the region.

Since most of the systems in South Central Montana operate in the conventional mode, the system-specific roaming mode is virtually identical to the shared channel mode. This mode of interoperable communications is used in several of the counties where many of the agencies have programmed Federal Government channels (Park Service, Forest Service and Bureau of Land Management) Channels into their radios. As noted in SECTION 3 of this report, there are many areas where the local users communicate on Federal Government Channels because of the lack of coverage on their own systems. In addition, incidents in some areas, such as the National Forests, or areas around Yellowstone National Park, frequently result in a dual federal/local response.

The highest level of interoperability comes when a standards-based shared system is used. Until recently, the standard mode of operation for both local, state, and federal public safety communications has been to use 25 KHz wide channels with FM modulation in an analog mode. For a number of reasons, that communications mode is no longer the standard.

As described elsewhere, the regulatory requirement to move to narrowband channels is one of the factors behind the move from the current mode. Other factors include the introduction of new technology, such as trunking, and the trend towards digital communications. P25 has been developed as the recommended standard for public safety in the United States and elsewhere. The Federal Government has adopted P25 as the standard for federal agencies. They have also instituted a requirement that any communications equipment purchased with Federal grant funds must be P25 compatible. P25 systems operate in either the conventional or trunked mode. The Montana State Interoperability Executive Council has adopted the goal of building a P25 standards based communications system throughout the State.

There are a number of factors that currently limit the ability of the agencies to operate effectively in the region. As noted in SECTION 3 of this report, these include:

- Significant coverage issues in all counties
- Design issues with some of the current systems in use contribute to the problem
- Insufficient attention has been paid to the transmitter sites. Not only are many of the facilities less than adequate, the lack of attention to good site engineering and maintenance has led to reduced coverage in a number of instances.
- Some agencies have obsolete equipment; some are using lower grade equipment which does not perform as well as public safety grade equipment
- Operational issues, such as the lack of training and procedures for responders, contribute to the problems as well.

In order to have improved interoperability, these issues with operability must be solved. The scarcity of resources, especially funding, is a severely limiting factor in the ability of the participating jurisdictions to implement the needed enhancements. Consequently, CTA Communications is recommending a phased approach. A general overview of our recommendations is presented below. Following the general overview is a more detailed description of the recommendations for each of the five counties.

Currently, all of the various non-federal systems in the five counties operate in the wideband (25 KHz) analog mode.

The United States Congress, as mandated in the National Telecommunications Authorizations Act of 1992, (P.L.102-538), has required that all Federal Government land mobile radio systems in the 162-174 MHZ band must be capable of operating in the 12.5 KHz narrowband mode as of January 1, 2005. Both the US Forest Service and the US Park Service are in the process of converting their operations in the area to narrowband. This will limit the ability of SCMIC units to communicate on the federal systems. We recommend that all equipment purchased be capable of operating in the narrowband, digital, P25, mode but initially operate in the wideband analog mode. Subscriber equipment (mobiles and portables) obtained as part of this upgrade needs to be capable of operating in the narrowband mode on selected channels. This is a standard feature of P25 compliant subscriber equipment.

While the Montana Mutual Aid and Common Frequency Plan provides a good basic level of interoperability between the various agencies, there are limitations. For the most part, communication on the mutual aid channels is limited to simplex, unit-to-unit communications. As a result, the range of the communications is limited. In addition, while the dispatch centers in each county have transmit capability on one or more of the mutual aid channels, this communication is generally limited to a single site for each center. Due to the large geographic area of each of the counties, there are significant areas where no communications exist between units in the field and a dispatch center on the mutual aid channels.

CTA recommends that the initial efforts be focused on addressing the site reliability issues and to assure that every police, fire and EMS agency has a minimal number of narrowband-capable radios to assure the ability to communicate on the Federal Government channels. These efforts will improve the ability of the responders from the same county to have interoperable day-to-day communications within that county. There are a number of areas and potential situations that could occur that would involve responders from more than one county. The Big Sky Area is an example of an area where responders from two different counties are likely to become involved. A major incident, whether a dam collapse at Earthquake Lake, a major hazardous materials incident on the Montana Rail Link or on I 90 in Park or Sweet Grass Counties, or a WMD incident at Montana State University are examples of potential incidents that could involve responders from multiple jurisdictions and counties.

7.1 Regional Interoperability Design

The goal of this project is to provide for an interoperable multimode radio communications environment for the five county area based on federal and state communication standards in which federal, state and local public safety and emergency management representatives can operate autonomously and transition seamlessly while communicating effectively in emergency mission roles as well as in other appropriate administrative and command and control roles. Any such environment must include the following elements:

- Improved Coverage
- Interoperability
- Non-Fixed or Subscriber Equipment
- Interconnectivity
- Paging and Alerting
- Dispatch Consoles
- Mobile Data
- Encryption
- Maintenance and Support

Following is a description of the overall system design for each of the elements listed above: It is followed in SECTION 7.2 by a description of design for each county in the region.

7.1.1 Improved Coverage

As we have described elsewhere in this report, the lack of adequate coverage is the most significant problem facing the members of the South Central Montana Interoperability Consortium. In every county, there are significant areas of poor coverage. Currently, SCMIC agencies are using twenty-six transmitter sites. We recommend that a total of thirty-nine transmitter sites be used. These sites are shown in FIGURE 7-1. In addition, we recommend that satellite receivers and comparators be used on the primary public safety dispatch channels to further improve the ability of users with mobile and portable radios to be able to access the repeaters. In addition, transmitter steering is recommended to improve the ease of operations for field personnel where feasible.

Because of the remoteness of some sites, some of the transmitter sites will continue to operate in a stand-alone mode. We recommend adding channels in several of the counties to reduce contention for channels that may be crowded in times of an emergency. Because the permissible distances between transmitters in a simulcast system is significantly reduced when the digital mode is used, we do not recommend the use of simulcasting at this time. Should the technology change, it may be something to consider in the future.

7.1.2 Interoperability

CTA Communications recommends that the SCMIC begin the migration towards the implementation of a P25 standards-based system. Any radio equipment purchased needs to be capable of P25 operation. While the equipment will initially operate in the current wide-band, analog mode, the plan is to migrate to the narrow-band, analog mode as soon as feasible as – no later than 2013, then move to P25 digital mode operations when appropriate. Initially, P25 operations will be in the conventional mode. Long-term, CTA Communications recommends that some areas of the region migrate to join the State P25 trunked system when and where appropriate.

As part of the efforts to improve the coverage and to improve mutual aid interoperability, we recommend that two common, repeated mutual aid channels be implemented in each of the five counties. Sufficient sites should be installed to assure mobile coverage throughout the region. CTA recommends that a total of thirteen sites be used in the five counties for transmitters on the mutual aid repeater channels. We recommend that the channels use satellite receivers and transmitter steering from each primary county dispatch center where feasible. The channels would be used primarily for tactical communications related to an incident. They could also be used, on a non-interference basis, for a unit from one county to be able to contact a dispatch center in one of the other counties in the region when they were in that county. While the same two frequency pairs would be used in all of the counties, each county would use a distinctive tone coded squelch frequency to access the channel in that county.

Because of the remoteness of some of the terrain in each of the counties, even with the enhanced coverage recommended, there are some areas where it is not feasible to provide the coverage necessary to support operations in a major public safety incident, whether it be a wild land fire, a search and rescue mission, or some other sort of task-force type of operation. Each of the five counties in the SCMIC regional currently has at least one portable repeater. We recommend that at least one additional transportable portable repeater be obtained for each of the five counties. The portable repeaters would be configured to operate in a stand-alone mode and used for tactical communications. The concept behind the use of the portable repeater is that they would be transported to a location in the area of an incident and used for tactical communications in the area of the incident. Typically, the portable repeaters operate in a stand-alone mode on a separate channel.

7.1.3 Non-fixed or Subscriber Equipment

Non-fixed or subscriber equipment is the term used to describe the mobiles, portables, and control stations used in the system for field personnel to communicate on the various channels. All of the subscriber units must be capable of operating in a new mode before operation in that mode can be implemented. For example, before narrow-band operations can be implemented on a given channel, all of the subscriber equipment that will use that channel must be capable of narrowband operations on that channel. Some of the SCMIC agencies have begun to purchase radios that are capable of P25 digital, conventional operation. A number of departments have older equipment that is not capable of narrowband or digital mode operation. Because the US Forest Service and the Park Service are rapidly converting to narrowband operation, it is critical that all agencies, especially rural fire and EMS agencies quickly obtain at least a minimal capability for narrowband operations. CTA Communications recommends that all new subscriber equipment be capable of P25 operation. We do not recommend that the equipment purchased initially necessarily be capable of trunked operation because of the additional cost of the trunking capable units. Subscriber equipment has a significantly lower life expectancy than the system infrastructure. Seven to ten years is the normal life expectancy for subscriber equipment. We recommend that all existing subscriber equipment be replaced by the end of the Mid-term phase of the project. When the equipment is replaced during the long-term phase of the project, trunking capable subscriber equipment should be purchased where required.

7.1.4 Interconnectivity

Currently, there are a variety of methods in use in the SCMIC to connect remotely located transmitter/receivers with the dispatch centers. Gallatin County makes limited use of a private microwave system. Some transmitter/receivers are connected by leased telephone lines; radio-links are used in other situations. Many of the repeaters are stand-alone transmitter/receivers. These are accessed by means of a control station. The implementation of advanced technology, especially trunking, will require that the base stations and dispatch centers be connected by means of a high reliability/capacity circuit. Typically, either a "T-1" circuit, leased from a common carrier, or a microwave frequency link is used. A "T-1" or "DS-1" circuit typically provides up to twenty-four voice grade channels between two points. Private microwave is generally more reliable than leased lines, although the terrain and weather in the SCMIC region make the provision of highly reliable microwave communications especially challenging. The Montana Highway Patrol is implementing a statewide microwave system. That network is scheduled to be expanded this year and will serve a portion of the SCMIC region. CTA recommends established a region wide microwave network, interconnected with the state network where applicable; to meet the interconnection needs of the region. The proposed network is shown in FIGURE 7-2.

There are several alternatives to be considered for providing the interconnection. These are described in detail in APPENDIX A. The alternatives include licensed microwave, licensed 4.9 GHz microwave, and unlicensed spread spectrum. The licensed microwave and the licensed 4.9 GHz are very similar. They are licensed under different parts of the FCC Rules and Regulations so there are some differences. Unlicensed spread spectrum is similar to the "wireless hot spots" found in motels, coffee shops and so forth. While it is considerably less expensive than the other alternatives, CTA in general does not view a spread spectrum interconnection as being the most desirable public safety grade alternative, because there are no regulatory safeguards on the interconnection There may be some limited, interim application until a full system is implemented.

7.1.5 Paging and Alerting

CTA recommends that the existing Gallatin County Digital be upgraded by adding GPS synchronization to the system. This will reduce or eliminate the problems with incomplete pages that is currently being experienced. We further recommend that a sub-system be added to the existing paging system to allow the dispatch center to monitor the integrity of the paging system. In addition, we suggest that, at such time in the future that the technology becomes more widely available and cost effective, the system be further upgraded to allow for two-way digital communications.

Because the required move to narrowband equipment will render the existing tone and voice pagers obsolete, we recommend that the remaining counties implement a similar digital paging system. While narrowband capable pagers are now being marketed, the high cost of these units leads us to not recommend their use at this time. Our recommendation could change if the cost of the narrowband pagers is reduced.

7.1.6 Dispatch Consoles

While the goal of the P25 standard is to enable radio equipment from one manufacturer to operate with the equipment from another manufacturer, there are some elements of a public safety communications system where the standard has yet to be completed. One of these areas is the dispatch consoles. Many of the dispatch consoles currently being used are not capable of operating P25 equipment. In addition, some of the consoles are no longer being supported by their manufacturer. Repair parts are no longer available new and must be obtained from used equipment. Additional dispatch positions are needed as well.

7.1.7 Mobile Data

The Bozeman Police Department, Belgrade Police, and the Gallatin County Sheriff's Department are among the first users of the statewide mobile data system. As the mobile data project moves beyond the pilot stage, the system will provide solid platform upon which to build a system that meets the needs of SCMIC non-law enforcement users.

These additional applications include such things as mapping, incident pre-plan information and so forth. There will be a need to expand the coverage of the system beyond that that is being provided or will be provided in the next phase of the project.

7.1.8 Encryption

Public safety communications systems frequently carry sensitive information. Protecting this information is essential to both the protection of life and property and addressing the privacy concerns of people involved. Many of the agencies we interviewed expressed a need for encryption of these sensitive communications. The various technologies available for us to encrypt communications in the current analog mode are at best ineffective. Analog encryption techniques not only do not provide a high degree of security, they also result in a significant reduction in the effective range of the radios involved. Encryption techniques that are available with digital communications afford a much improved level of security and do not have an impact on communications range. The Digital Encryption Standard (DES) is currently the accepted standard for P25 systems. The Advanced Encryption Standard (AES) offers a higher level of security than DES. While it is the standard for information technology systems, AES encryption is more expensive to implement that DES. CTA recommends that the SCMIC standardize on DES for P25 operations since it provides excellent security, is standards based, and allows broad vendor interoperability. Moving to AES in the future (as the price comes down) should be a software (or board change) upgrade, as all of the manufacturers of P25 encryption modules include both DES and AES capability. An additional consideration, if regional encrypted communications is truly desired, is a carefully thought-out encryption key management plan including Over the Air Re-keying (OTAR) to allow for the proper synchronization of key upgrades for cross-agency use.

7.1.9 Regional Maintenance and Support

Currently each agency in the SCMIC region uses differing methods and has different levels of maintenance for their radio infrastructure and field units. Most repairs are done on an agency by agency basis.

While some maintenance agreements exist, most of the work is performed on an hourly basis by at least six different service shops. Preventative maintenance has been a low priority. In order to improve the two way radio environment in the region there should be a restructuring of how maintenance and particularly preventative maintenance is approached by the participating counties.

The first logical step is to combine the purchasing power of the five counties to develop a regional maintenance agreement. We recommend that the SCMIC develop a standardized pricing list with the maintenance providers on a competitive basis.

CTA notes that economic advantages could only be realized if it is the commitment of all of the agencies in the SCMIC to remain within the framework of the standardized price and service list. This action could be done without a formal agreement among the counties and would not require the creation of a new multi-county legal entity.

In the long term, the SCMIC may wish to explore the creation of a combined maintenance organization. This organization could take the form of a joint county-owned radio shop that serves all of the SCMIC participants. It could also take the form of a joint-county team of employees who provide oversight to a commercial operation dedicated to the participating counties. The commercial operation could be a division of an existing maintenance provider or a newly created radio shop. The commercial services should be created and established via a competitive bidding process. The use of commercial services in this manner would allow for an operation directed by the participants but would not necessitate the purchase of large amounts of radio repair and test equipment. The regional maintenance organization would require the adoption of formal agreements between the SCMIC counties and perhaps the establishment of a new legal entity.

7.1.10 Radio Traffic Analysis

When reviewing the dispatch channel pool in use throughout the entire SCMIC region, we find some channels with sufficient numbers of radio users where we can draw useful conclusions from a traffic loading analysis. There are some other channels where congestion is a problem at times, for instance, the “Sheriff’s Channel” that “everyone” uses in Madison County.

Without further study, we suggest going directly to the obvious solution of licensing additional channels. These situations and suggestions for new channels and their application are discussed in this report Section under specific county recommendations.

The situation in Northern Gallatin County for the Law Enforcement and Fire agencies warrants a closer study. The area we are looking at is the entire north Gallatin County valley, the City of Bozeman, and south to about Big Sky. We include all law and fire personnel that are paged and then dispatched out of the Bozeman Law and Justice Center, and exclude areas primarily dispatched from West Yellowstone. All these law enforcement and fire personnel are primarily dispatched on four channels:

Channel Name	Primary Agency
• North Repeater	Gallatin Sheriff's Office
• Fire North	County Fire and EMS
• Bozeman PD Dispatch	Police Department
• Bozeman FD Dispatch	Fire Department

Using our PCALA traffic loading analysis tools, we examine the loading on these channels to see how they are holding up now and how they will perform in 20 years based on projected population growth. We recognize that secondary incident and fire ground channels carry some of the traffic in the Gallatin valley, but we are looking here only at the dispatch channels where users are required to work most of the time.

We determined traffic volume using your 911 call center statistics for calendar year 2004 in which calls-for-service volume was provided for all law and fire agencies. Using information from our interviews, we allocated agencies to the dispatch channels and also estimated the numbers of radios active during busy hours in the day.

Information was also provided to us on County population growth over the next 20 years. In our experience, the number of calls for service will increase roughly proportionally to your population growth. This allows us to estimate future call volume, for the purposes of this analysis; on the same four dispatch channels. Based on our experience, we estimated the average number of radio PTT's per incident, allowing us to make assumptions about total call volume.

Then, again based on experience from traffic analysis for many customers, we applied typical call durations for Law, Fire, and EMS operations, allowing us to arrive at consumed airtime.

We examined both conventional and trunked traffic loading. While trunking is not our near term recommendation, it is informative to compare how many trunked channels would be required to carry the load of current and future North Gallatin area operations.

Radio traffic analysis was performed using Erlang C model for a trunked radio system. This analysis reflects the mathematics, statistics, and the probabilities associated with blocking conditions experienced on conventional and trunked radio systems.

Loading Model Definitions

To help the reader understand the radio traffic analysis, some basic definitions are provided that pertain to the traffic analysis:

A. Erlang

A traffic engineering term used to measure the communications load for a circuit or set of circuits. One Erlang is defined as one person speaking continuously. For the purpose of this analysis, 1 Erlang is equivalent to 1 person speaking for 3600 seconds in 1-hour increments.

B. Erlang C Model

The Erlang C formula is used to determine the probability that a call is blocked. The formula assumes that calls that cannot be immediately be assigned a radio channel are held in a queue. Erlang C is typically used for trunking systems where calls are automatically queued and than de-queued when a channel becomes available. The Erlang C formula is based on the following assumptions:

- Calls are served in order of arrival
- Blocked calls are delayed
- Blocked calls are placed in a queue with an infinite length.

C. Grade of Service (GOS)

GOS is a measure of the ability of a user to access a trunked system during the busiest hour of radio operation. GOS is typically given as the likelihood that a call is blocked. GOS is calculated as a percentage of calls that are blocked.

D. Delayed Call GOS

The probability that a delayed call is forced to wait more than the maximum acceptable call delay (t seconds).

E. Busy Hour

This is the busiest hour of each week on the radio system. Radio systems are designed and sized to comfortably handle this routine (not emergency) high traffic time. For many Public Safety operations, this time occurs between 15:00 and 21:00 hours each weekday. Activities at the end of the workday and beginning of the evening usually coupled with a law enforcement shift change yields peak radio traffic. Typically, busy hour radio traffic runs about 60% higher than average traffic.

Traffic Loading Model

Design goals for both trunked and conventional LMR systems are to deliver a specific call capacity at a GOS conducive to clear, reliable communications. The busy hour is based on user demand at the busiest operational hour during a week. GOS is typically given as the likelihood that a call is blocked, or (for trunked LMR systems) the likelihood that a call is experiencing a delay greater than a certain queuing time.

Conventional LMR system call capacity is treated differently from a trunked LMR system. Conventional LMR systems do not have a queue to hold calls when a call is blocked or when a channel is busy like a trunked system. Generally, a conventional system has difficulty handling a large number of subscribers with a limited number of channels during the busiest hour without experiencing a large number of blocked calls or busy channels. A trunked LMR system is designed to hold a call in a queue if a channel is busy and once the channel is open, the call is automatically connected to the next open channel minimizing access delay.

The primary guidance used in the industry for user loading on conventional channels is the FCC Part 90 Regulations. The FCC establishes guidelines on when issuance of a new channel license is justified. Under Section 90.313 Frequency Loading Criteria, a maximum of 50 users per conventional channel in the Public Safety Pool is suggested.

The Erlang C model is used to simulate a transmission trunked LMR system. The same number of North Gallatin busy hour users and their call profile is used to determine the number of trunked channels required. The Erlang C model simulates the number of calls being blocked and placed in a queue. If a radio channel is not available immediately in the trunked system, the call request may be delayed until a channel becomes available. The Erlang C model calculates a GOS as defined as “the probability that a call is blocked after waiting a specific length of time in the queue”.

Traffic Loading Analysis Results

We conducted our traffic loading analysis using information gathered during agency interviews or provided later by SCMIC agencies. The traffic loading analysis uses the following assumptions:

- The numbers of radio users is estimated from the numbers of portable radios
- Call volumes are based on 2004 Gallatin County 911 annual calls for service
- Future call volumes are based on project Gallatin County population growth

Based on the above assumptions and our experience with previous traffic loading analysis studies conducted by CTA, we compute other data to arrive at channel loading and requirements for the four main dispatch channels in North Gallatin County.

- Average number of radio calls per dispatch
- Call profile for law and fire operations: calls per hour, call duration, inter-call timing
- Relationship of average call volume to busy hour cal volume

Please note that these calling parameters are based on average calling conditions using a portion of the total number of portables SCMIC's inventory as the number of active radio units at any one time. This will be considered the busy hour.

For this analysis, we determined the number of Erlangs by the following expression:

$$\text{Erlangs} = \frac{\text{(Average Voice Calls/busy hour/radio unit)} \times \text{(Average Call Length)} \times \text{(Number of Subscriber Units)}}{\text{3600 Seconds}}$$

Conventional LMR System Analysis

TABLE 7-1 illustrates the channel loading characteristics for the primary North Gallatin County dispatch channels. The upper table is representative of your current situation and is based on the current number of radio users and 2004 911 center statistics. The lower table portrays the situation in 20 years and is based on projected call volumes and numbers of radio users in 2025.

In the upper table, total users are an estimate of your current user population derived from the sum of Immediate, Near, and Mid Term portable costing quantities. Busy hour users are our estimate of active radios during weekly busy hours. Numbers are based on such factors as three-shift law operations and generally lower levels of active fire radios. Average PTTs per hour is the average of 24 hour-a-day call traffic experienced now for the different agencies. Busy hour traffic is calculated as 1.6 times average traffic. Based on the FCC guideline of 50 units maximum per conventional channel, we see that none of the four agencies really come close to needing more than one channel. This of course assumes that radio users adhere to appropriate radio discipline and limit unnecessary traffic.

In the lower, we look at the situation 20 years out. Total user count is based on the number of portables contained in the Long Term non-fixed cost estimates. We added 5% additional users as margin to make sure and not underestimate the situation. 2025 Dispatches (calls-for service) is the 2004 call volume escalated by 40%. This models a linear increase in calls for service and is based on projected population increase provided by SCMIC. As can be seen, both the number of busy hour users and their frequency of radio calls increase over 2004 levels. Even these additional users, we still do not approach 50 busy hour units on any of these channels.

Trunked LMR System Analysis

For comparison purposes, we processed the Gallatin busy hour traffic characteristics through the Erlang C traffic model to examine 1) how many trunked channels would be required to carry the traffic, and 2) the operating characteristics of such a trunked system.

<u>For 2004 user counts and call volume:</u>

- Total Number of Busy Hour Subscribers = 86
- Average Call Length = 3 seconds Law, 6 seconds Fire
- Average Voice Calls/hour/radio unit = varies by agency from 1 to 4
- Working Channel Call Overhead = 1.0 sec (Time to access and drop the call)
- Maximum Acceptable Queue Delay = 1 Second
- Delayed Call Grade of Service Limit = 1% (Public Safety target of no more than one call per hundred delayed more than 1 second)
- Transmission Trunking (an efficient call processing mode)

Based on the input parameters above, the following results are observed:

- Voice Channels Required = 3
- Total System Channels = 4 (allowing for one control channel)
- Total Load = 0.24 Erlangs
- Percent of Voice Channel Airtime Used = 8.1%
- Basic GOS = 0.20% Blocked Calls
- Basic Delayed Calls = 0.002 calls per 100 experience any delay
- Delayed Call GOS = 0.114%
- Delayed Calls = 0.001 calls per 100 (Calls delayed more than 1 second)

<u>For projected 2025 user counts and call volume:</u>

- Total Number of Busy Hour Subscribers = 107
- Average Call Length = 3 seconds Law, 6 seconds Fire
- Average Voice Calls/hour/radio unit = varies by agency from 1 to 4
- Working Channel Call Overhead = 1.0 sec (Time to access and drop the call)

- Maximum Acceptable Queue Delay = 1 Second
- Delayed Call Grade of Service Limit = 1% (Public Safety target of no more than one call per hundred delayed more than 1 second)
- Transmission Trunking (an efficient call processing mode)

Based on the input parameters above, the following results are observed:

- Voice Channels Required = 3
- Total System Channels = 4 (allowing for one control channel)
- Total Load = 0.34 Erlangs
- Percentage of Airtime Used = 11.2%
- Basic GOS = 0.51% Blocked Calls
- Basic Delayed Calls = 0.005 calls per 100 experience any delay
- Delayed Call GOS = 0.287%
- Delayed Calls = 0.003 calls per 100 (Calls delayed more than 1 second)

Final Analysis

From the analysis performed above we can draw several useful conclusions. First, the four conventional channels currently used to dispatch North Gallatin Valley resources are adequate for the job both now and for the foreseeable future. This of course assumes that during busy periods, users conserve airtime by keeping unnecessary traffic to a minimum. We estimate the two law enforcement channels as carrying an average of around 25 active users during busy times. When you find the busy hour count to approximately double, you should begin to consider additional channels.

Secondly, if trunking technology were employed for this region and function, it would also require four channels. If we were to reduce system size to a three channel system (2 voice channels) this would result in almost 2 calls per hundred (about twice our target) blocked for excessively long time. On the other hand, this four channel trunked concept system would be very lightly loaded – in the neighborhood of 8 – 11%. We typically design public safety systems for 40 – 60% busy hour loading. This design target generally provides a reasonable tradeoff between satisfactory peak loading capacity and cost.

7.2 County-by County Interoperability Design

Following is a high-level description of CTA Communications recommendations for each of the counties in the SCMIC. As part of the implementation, detailed system design will be required before the improvements can be implemented. The detailed design efforts will include such elements as tower and antenna height, transmitter output power, antenna gain, and so forth. These efforts are beyond the scope of the current project.

7.2.1 Gallatin County

Gallatin County includes the City of Bozeman and Montana State University.

Improved Coverage

Currently fourteen transmitter sites are used by the different agencies in Gallatin County. CTA recommends that satellite receivers and comparators be added to both the Bozeman Police and Fire channels as well as the Montana State University system in order to improve the talk-back coverage from portables, especially in buildings. Based on information provided to CTA, we also recommend that efforts be undertaken to locate and remediate the interference issues reported on the Bozeman Police Department channels and the MSU system. The effective performance of these channels is significantly less than the design level.

For the “North Repeater” channel, used by most law enforcement agencies in the county, and “Fire North”, the primary fire dispatch channel for the Gallatin Valley, we recommend that satellite receivers and transmitter steering be added. Both channels currently operate from a single site. We recommend that four additional repeater sites be added on both channels in order to both fill in areas where poor coverage was reported and to provide overlapping coverage to assure the continuity of operations in the event of the loss of any one site. As shown in FIGURE 7-1, we recommend that the following sites be used for both the “North Repeater” and “Fire North”: Bridger Ridge, High Flat, Logan Repeater, Three Forks, and Timberline.

For the Gallatin County "South Repeater" channel we recommend that the existing repeater at Eagle Head be phased out and new repeaters be installed at Cinnamon Mountain, Andesite Mountain, and West Yellowstone. This channel should also incorporate satellite receivers and transmitter steering. We further recommend that the North and South repeater channels be linked together so that communications on one channel would be heard by users on the other channel.

Tactical Channels: As noted above, the Bozeman Police Department's tactical repeater channel operation receives interference from the Montana State University channels. The tactical repeater should be relocated or additional measures taken to reduce the interference and make the channel more usable. CTA recommends the Fire East Tactical repeater be relocated from the Fort Ellis Fire Station to the new site being established at Timberline.

We also recommend that the two divisions of the Bozeman Department of Public Works that are using a UHF channel migrate to VHF to provide consistency and to improve interoperability.

With the number of agencies involved and the rapid growth trends, Gallatin County, including the City of Bozeman, is the most likely candidate for migration to the statewide trunking system in the long term. Before any migration to trunked operation can occur, the coverage issues, interconnectivity, and subscriber equipment upgrade must take place in order for the trunked system to function. Any subsequent migration must be based on operational needs. It must be emphasized that even if the system migrates to trunked operation, there will be a need for conventional (non-trunked) channels for tactical operations. Industry standards, such as NFPA 1221, stipulate that conventional tactical channels be available. The concern is that communications at localized operations, such as at a critical incident involving a SWAT deployment or a structure fire, should not be dependent on an infrastructure. Units should be able to communicate unit to unit immediately. Since there may also be a need for wide area tactical communications, there is a need to provide for both conventional simplex, as well as repeated channels for tactical operations.

Interoperability

We recommend that Mutual Aid channel repeaters by installed at the following three sites in Gallatin County: Bridger Ridge, West Yellowstone, and Three Forks.

Non-Fixed or Subscriber Equipment

A number of agencies in Gallatin County have obtained at least some equipment that is both narrow-band and P25 capable. However, there are several agencies that have no narrow-band capable units. All subscriber equipment should be brought up to narrow-band, P25 capable units. During the mid-term, a life cycle replacement should be completed of all of the existing units. During the long-term phase trunking capable units should be obtained as part of the next life cycle replacement to enable the migration to trunked operation.

Interconnectivity

We recommend that the exiting Gallatin County microwave system be expanded to provide the necessary connectivity to the repeater sites and interfaced with the state microwave system. There is also a recommended connection between the Gallatin/Bozeman 9-1-1 Center and the EOC.

Paging and Alerting

As noted above, CTA recommends that the existing Gallatin County Digital paging be upgrading by adding GPS synchronization to the system. The technology involved uses GPS receivers at each transmitter site to synchronize the transmissions over the paging system. This will reduce or eliminate the problems with incomplete pages that are currently being experienced. We further recommend that a sub-system be added to the existing paging system to allow the dispatch center to monitor the integrity of the paging system. In addition, we suggest that, at such time in the future that the technology becomes more widely available and cost effective, the system be further upgraded to allow for two-way digital communications.

Dispatch Consoles

The Bozeman/Gallatin 911 Center's current consoles are adequate for the near and mid-term phases of the project. Consoles are also added to the EOC for back-up and emergency operations. In the long-term phase of the project, the consoles will have to be upgraded to operate with trunked equipment. At this time, consoles are not interoperable for P25 systems. Consoles are one of the elements of the suite of standards that will be addressed in P25 Phase 2.

Mobile Data

The Bozeman Police Department and the Gallatin County Sheriff's Office are two of the agencies participating in the pilot phase of the state mobile data system. At the current time, the system only provides law enforcement relayed applications such as access to the state criminal justice information network, the National Crime Information and limited inquiry capability into the local records system. Some Gallatin County law enforcement agencies may desire to add terminals on the system before the system is expanded to provide additional functionality and features.

Encryption

One the migration to digital capable radios is complete, DES encryption should be implemented. It can be implemented on a selected basis. Not all channels will need encryption capabilities.

Maintenance and Support

Because there are more resources available in Gallatin County than in the other counties in the SCMIC, the efforts to consolidate and coordinate the maintenance and support functions should begin in Gallatin County.

7.2.2 Madison County

Improved Coverage

The number of sites used in Madison County needs to be increased from the current four sites to eight sites in order to provide the needed coverage. All of the existing sites continue to be used. New sites are added at the following locations: The USFS Lazyman repeater, Twin Bridges; and Gold Butte. In addition Madison County repeaters are installed at the new Gallatin County site at Three Forks. A new site is also recommended needed in the Big Sky area, the best solution is Andesite Mountain, which is currently being used by Gallatin County. The Andesite site offers year round access.

We also recommend that an additional channel be added at all sites for fire and EMS communications. This second channel can also be used for communications with medical control. These communications currently share the same channel as law enforcement communications. The Madison County Road Department channel should be converted to a repeated channel and transmitters co-located with the other channels to provide improved communications. The Madison County Sheriff's Office, the Meagher County Sheriff's Office and the Association of Public Safety Communications Officials International (APCO) Local Frequency Advisor should work together to resolve the tone coded squelch issue that causes both counties to receive interference from each other on the shared channel.

Interoperability

CTA recommends that repeaters on the regional mutual channels be installed at three sites (Norris Hill, Gold Butte, and Andesite).

Non-Fixed or Subscriber Equipment

The subscriber equipment in Madison County is in the most critical need of replacement of all of the five counties. Many of the rural fire departments, ambulance services are using hand-me-down equipment or units that were purchased by members with their own funds that are not capable of narrowband operation. With over one half of the land area in Madison County being federal land, there is an acute need to assure that the subscriber equipment is capable of narrowband operations and further capable of migration to P25 digital communications. Due to the relatively low density of population and radio users, it is unlikely that trunking will be feasible for Madison County during the life of this project.

Interconnectivity

Because Madison County is some distance from Interstate 90, providing interconnectivity is a bit challenging. We recommend that the interconnectivity to the state microwave system be established at Red Mountain or Table Mountain on the Silver Bow County line. The link to that site is part of the I15-90 consortium effort. This link would also be used to connect to both southern Gallatin and Park counties.

In addition to providing the needed connections between the repeater sites, the link could be used to interconnect the dispatch center with the CAD server in Bozeman and to provide access to the statewide mobile data system.

Paging and Alerting

Our recommendation is that, initially, paging should continue on the existing Sheriff's channel. A new encoder is urgently needed to allow for additional capacity. This can be done as part of the console upgrade discussed below. Long-term, we recommend that a separate digital paging channel be obtained and a digital paging system be installed.

Dispatch Consoles

The dispatch consoles at the Madison County Sheriff's Department should be replaced as soon as funds are available since the Motorola Centra-Com II consoles. At the latest, this replacement needs to take place in the near-term phase. In the long-term phase, the consoles will need to be replaced with a P25 compatible console. There is no console compliant with the TIA P25 standards at this time since TIA standards for the console interfaces do not yet exist.

Mobile Data

In the long-term phase, after interconnectivity is established, access to the statewide mobile data system should be made available to the Madison County Sheriff's Office and the Ennis Constable. At such time as additional applications are made available that would meet the needs of other public safety users, the system could be expanded to include them. In the interim, the ambulance services and fire departments may wish to consider obtaining laptop computers and installing software capable of displaying maps from the county GIS department.

Encryption

Once the migration to digital capable radios is complete, DES encryption should be implemented. It can be implemented on a selected basis. Not all channels will need encryption capabilities.

Maintenance and Support

We recommend that Madison County participate in the regional maintenance organization as soon as it is available.

7.2.3 Meagher County

Improved Coverage

We concur with the efforts by the Meagher County to add two additional sites to their existing mix of sites. We recommend that satellite receivers and comparators be added to the channels.

Interoperability

Mutual aid repeaters should be installed at both the Kings Hill (Porphyry's Peak) site and at the new Black Butte site.

Non-Fixed or Subscriber Equipment

New subscriber equipment purchased should be both narrowband and P25 capable. Due to the relatively low density of population and radio users, it is unlikely that trunking will be feasible for Meagher County.

Interconnectivity

Connecting Meagher County to the remaining counties in the SCMIC by microwave is also challenging. We suggest that the best path to do this is to establish a microwave path to Helena and then use the statewide microwave system to connect to the other SCMCI counties.

Paging and Alerting

Tone and voice paging should continue on the existing UHF paging channel until such time as a digital paging system is implemented.

Dispatch Consoles

The existing Zetron desk top remote consoles will need to be replaced with a P25 compatible console before P25 operation is implemented.

Mobile Data

Once the interconnection to the statewide microwave network is accomplished, access to the statewide mobile data network can be achieved for law enforcement users.

Encryption

As with the other counties, once the migration to digital capable radios is complete, DES encryption should be implemented. It can be implemented on a selected basis. Not all channels will need encryption capabilities.

Maintenance and Support

We recommend that Meagher County participate in the regional maintenance organization as soon as it is available.

7.2.4 Park County

Improved Coverage

The existing transmitter site at the North Hill in Livingston should be phased out of use by Park County. We recommend that the county-owned site at Meyers Flats provides significantly better coverage than the North Hill site. We recommend that Sheriff's Office repeater channel, currently not in use, be installed at the Meyers Flat, North Hill and Paradise Valley Fire sites. We recommend that new repeaters be installed at Dome Mountain, Sheep Mountain and Cooke City. CTA suggests that the Livingston Fire Department use the county fire repeater channel instead of their own channel and that the county fire channel be installed at the same locations as used by the Sheriff's channel. Satellite receivers, comparators and transmitter steering are recommended for both channels.

The distances between the transmitter sites are such that simulcasting would be marginal at best in the current wideband analog mode and significantly too widely spaced for digital, narrowband operations. The Cooke City site would need to operate as a stand-alone site, but still be tied back to dispatch in Livingston to facilitate communications.

Interoperability

Mutual aid interoperability channel repeaters will need to be installed at the Myers Flats, Dome Mountain and Cooke City sites in order to provide adequate coverage.

Non-Fixed or Subscriber Equipment

New subscriber equipment should be both narrowband and P25 compatible units. Those agencies in southern Park County need to be certain that their equipment is narrowband capable before the US Park Service fully converts to narrowband operation.

Interconnectivity

The statewide microwave system is scheduled to be expanded and to extend through Park County this year. The microwave path will extend roughly parallel to Interstate 90. CTA recommends that a spur from this system be used to connect to the Myers Flats site. In addition, connectivity to the Sheep's Mountain site be accomplished through the link used to connect the Lone/Mountain/Andesite Mountain site to the network. An alternative is to use the existing QWEST link between West Yellowstone, Mammoth Hot Springs, and Livingston.

Paging and Alerting

Initially Park County paging operations will need to continue as they are currently. When feasible, CTA Communications recommends that Park County implement a multi-site, GPS synchronized, digital paging system. A minimum of three sites will be needed. If the digital paging system is to be extended into Southern Park County, two additional transmitters will be needed to cover Gardiner and Cooke City.

Dispatch Consoles

Park County upgraded their dispatch consoles this year. The consoles will need to be upgraded or replaced with P25 compatible consoles before P25 operations begin.

Mobile Data

As the microwave backbone is built out this summer, connectivity to the mobile data network will be available. Its use will be limited to CJIN and NCIC inquiries since Park County's computer system does not provide full computer aided dispatch. With the extension of the microwave, it will be feasible for Park County to use the Gallatin County CAD system. This could result in additional functionality for the mobile data system and increase the interoperability between counties.

Encryption

As with the other counties, once the migration to digital capable radios is complete, DES encryption should be implemented. It can be implemented on a selected basis. Not all channels will need encryption capabilities.

Maintenance and Support

Participation in the regional maintenance effort will provide benefits to Park County.

7.2.5 Sweet Grass County

Improved Coverage

The two existing repeater sites in Sweet Grass County will be augmented by additional repeater sites at Quebec Siding and Porcupine Butte. An additional channel will be needed at all four sites for fire and ambulance communications. Satellite receivers and comparators should be added to all of the channels. Transmitter steering may be an option to be considered.

The two new base stations that have just been installed at Tin Can Hill mean that Sweet Grass County has some narrowband and P25 capability already. These two base stations should last for the duration of this project.

Interoperability

Repeaters on the mutual aid channels should be installed at both the Tin Can Hill and Monument repeater sites.

Non-Fixed or Subscriber Equipment

Subscriber equipment needs to be updated to assure compatibility with the narrowband requirement and to be P25 capable before ether migration step can occur.

Interconnectivity

Sweet Grass County is also included in this year's extension of the statewide microwave system. We recommend that an interconnection system be installed in Sweet Grass county and interfaced with the state system.

Paging and Alerting

When the new fire channel is implemented, consideration should be given to moving paging for fire and ambulance personnel to that channel using the existing pagers. This will eliminate the interference being received from the Pioneer Medical Center using the same channel and improve coverage as well. Long-term, paging operations should move to a separate paging channel. With the narrowband requirement, a conversion to a digital paging system on a dedicated channel is the most feasible solution at this time.

Dispatch Consoles

In the near-term, we recommend the addition of a second console at the Sweet Grass County Sheriff's Office to replace the mobile radio being used currently. Long-term the existing Zetron desk top remote console will need to be replaced with a P25 compatible console before P25 operation is implemented.

Mobile Data

As the microwave backbone is built out this summer, connectivity to the mobile data network will be available. Its use will be limited to CJIN and NCIC inquiries since Sweet Grass County's computer system does not provide full computer aided dispatch. With the extension of the microwave, it may be feasible for Sweet Grass County to use the Gallatin County CAD system. This could result in additional functionality for the mobile data system and increase the interoperability between counties.

Encryption

As with the other counties, once the migration to digital capable radios is complete, DES encryption should be implemented. It can be implemented on a selected basis. Not all channels will need encryption capabilities.

Maintenance and Support

Sweet Grass County may also benefit by participating in the regional maintenance effort. In addition, efforts should be undertaken to standardize the programming of the radios that are being used in the system.

7.3 Implementation Plan

Any major transition and implementation plan, such as recommended here for the SCMIC, is only feasible when performed in s logical, phased approach. CTA Communications recommends that five conceptual phases be used: Immediate; Near Term, Mid Term, Long Term and Far Term. Each phase, except for Immediate, has activities that address the areas of:

- Improved Coverage
- Interoperability
- Non-Fixed or Subscriber Equipment
- Interconnectivity
- Paging and Alerting
- Dispatch Consoles
- Mobile Data

- Encryption
- Maintenance and Support

Specific times frames indicated are only approximations since each county and agency is in a different radio and financial situation. The availability of grant funding will also have a very significant impact on the implementation timetable. Mid-term and long-term activities will require coordination and planning on a regional basis. We describe next the general characteristics of each of the four phases. These are common goals for each SCMIC County:

Immediate (As soon as possible)

- Critical Site Improvements (grounding and back-up power)

- Critical Subscriber Units (minimum of two narrowband capable units per emergency response agency to assure some ability to communicate with Federal agencies.)

Near-Term (12-24 months)

- Improved Coverage – The major goal of this phase is to improve coverage in each county. This will be accomplished by adding sites and channels throughout the region. In addition, satellite or voting receivers and comparators will be added as will transmitter steering for selected systems.

- Interoperability – Begin the implementation of the consortium-wide mutual aid repeater network. The implementation of the system would be conducted over both the near and mid-term phases of the project. The key determinants will be the availability of connectivity and funding.

- Non-fixed Equipment – In this phase, the current unmet needs for subscriber equipment will be met and the phased upgrade of the remaining subscriber equipment will begin.

- Interconnectivity - Begin the installation of interconnectivity (microwave) improvements as necessary to support the site improvements, and, where applicable, future goals.

During the Near-Term Phase efforts will be focused on expanding the existing microwave system in Gallatin County and using the State microwave system.

- Paging and Alerting – The Gallatin County digital paging system will be upgraded by adding GPS-based synchronization. Paging coverage in the other counties will be improved as part of the coverage enhancements. For the most part paging will remain on the existing channels for the near-term.

- Dispatch Consoles – Replace those consoles that are obsolete.

- Mobile Data – Some agencies may wish to use the statewide mobile data system if coverage is available in their service area, but no consortium-wide effort is planned during this phase.

- Encryption – Since operations will remain in the analog mode during this phase, no major efforts to upgrade the encryption capabilities are planned. New subscriber equipment purchased during this phase for those units that will use encryption when available should be equipped with the P25 DES encryption capability.

- Maintenance and Support – Standardize radio programming and procedures and move toward shared maintenance resources.

Everything accomplished in this phase will benefit future implementation phases.

Mid-Term (2-5 years)

- Coverage – Complete the installation of any sites and channels that have not been completed.

- Interoperability – Complete the installation of the consortium-wide mutual aid repeater network.

- Non-fixed equipment – Complete the upgrading of all subscriber equipment to P25 capable units.

- Interconnectivity – Complete the installation of interconnectivity network using microwave, spread-spectrum, or a combination of both.

- Paging and Alerting – Begin the conversion of paging systems in Madison, Meagher, Park and Sweet Grass Counties to a digital network.

- Dispatch Consoles – Add any consoles needed for dispatch center expansion

- Mobile Data – No consortium-wide effort planned during the mid-term phase

- Encryption – Analog operations will continue in this phase as well. Some conversion to digital operations may occur for selected channels. That will allow implementation of DES encryption.

- Maintenance and Support – The agreed upon regional maintenance and support plan should be placed in effect during this phase.

Long-term (5-10 years)

- Coverage – Some coverage improvements may need to be completed. All channels switch to narrowband operation with further migration to P25 conventional when feasible.

- Interoperability - The regional mutual aid repeater network should be completed. In addition, where indicated, operations will migrate to the statewide trunked system when feasible.

- Non-fixed equipment – Based on a seven to ten year useful non-fixed equipment life span, all non-fixed equipment will be replaced during this phase. Trunking capable units will be acquired for those areas where trunking will be implemented.

- Interconnectivity – Upgrade to provide seamless interconnectivity between the entities in the SCMIC.

- Paging and Alerting – The conversion to digital paging should be complete. Life cycle replacement of pagers will be needed. If feasible, two-way paging can be implemented

- Dispatch Consoles – All consoles will need to be replaced with P25 capable units before P25 operations can begin. At this point all SCMIC counties will be able to connect their console via the microwave system. This will allow dispatcher interoperability at a larger level.

- Mobile Data – An independent mobile data system or systems will be implemented to expand the functionality and available applications. Interoperability with the statewide network will be maintained.

- Encryption – With the migration to P25 operation, P 25 compliant DES encryption will be implemented. As noted above, AES encryption may be a cost-effective alternative by the time P25 is implemented in the SCMIC. Because of the enhanced level of security it offers, AES encryption should be implemented when feasible.

- Maintenance and Support – The agreed upon maintenance and support plan will be in effect and implemented.

<u>Far-term (10-20 years)</u>

- Improved Coverage - Coverage improvements should have been completed before the far-term phase begins.

- Interoperability- In those areas where operational needs indicated that trunking is appropriate, migrate to P25 trunking. The system will combine P25 trunked and P25 digital / analog conventional technologies to provide interoperable communications among P25 narrowband digital trunked and existing conventional users. All equipment will be compatible and seamlessly integrate with infrastructure equipment deployed in CDP 1 - Southwest Interoperability Project and CDP2 - Northern Tier Interoperability Project.

- Non-Fixed or Subscriber Equipment - Based on a seven to ten year useful non-fixed equipment life span, all non-fixed equipment may need to will be replaced again during this phase. Trunking capable units will be acquired.

- Interconnectivity - Provide connectivity between each SCMIC county and the other system such as: the CDP 1 - Southwest Interoperability Project and CDP2 - Northern Tier Interoperability Project.

- Paging and Alerting - Transition to trunking protocols may be available at this time; however the existing systems will maintain their functionality

- Dispatch Consoles - Console connections will require conversion to trunking protocols.

- Mobile Data - Expand the use and function of the units for each county

- Encryption - SCMIC law enforcement agencies may be required at this point to adapt to the larger trunking system encryption standard that may be in place at that time. Any change should be a programming effort only.

- Maintenance and Support - Trunking system due to their nature require a more intensive maintenance effort. The maintenance program will need to be fully in place and effective with the implementation of a trunking system.

TABLE 7-1
RADIO TRAFFIC ANALYSIS
NORTH GALLATIN COUNTY

Year 2004 Channel Loading

CHANNEL DESIGNATION	UTILIZATION	Total Users (1)	Dispatches 2004 (2)	Avg PTT/Hr	Busy Hour PTT/Hr (3)	BH fraction of radios	Busy Hour Users	Busy Hour PTT/Hr/unit	Channels Req'd (4)
North Repeater	Gallatin County North Law Enforcement	74	35361	40	65	0.33	24	2.6	1
Fire North	Gallatin Fire North, Fire and EMS	605	5610	6	10	0.05	30	0.3	1
Bozeman PD	Bozeman Police Department	52	35862	41	66	0.33	17	3.8	1
Bozeman FD	Bozeman Fire Department	44	1921	2	4	0.33	15	0.2	1

Year 2025 Channel Loading

CHANNEL DESIGNATION	UTILIZATION	Total Users (6)	Dispatches 2025 (5)	Avg PTT/Hr	Busy Hour PTT/Hr (3)	BH fraction of radios	Busy Hour Users	Busy Hour PTT/Hr/unit	Channels Req'd (4)
North Repeater	Gallatin County North Law Enforcement	78	49505	57	90	0.33	26	3.5	1
Fire North	Gallatin Fire North, Fire and EMS	642	7854	9	14	0.05	32	0.4	1
Bozeman PD	Bozeman Police Department	76	50207	57	92	0.33	25	3.7	1
Bozeman FD	Bozeman Fire Department	73	2689	3	5	0.33	24	0.2	1

Notes:
1. Total 2004 users is approximated based upon portable radio inventory. This is the sum of portables included in the Immediate, Near, and Mid Term non-fixed cost estimates.
2. Based on calls for service provided by Gallatin Co 911
3. Busy hour call PTT volume is approximately 1.6 times average volume
4. Based on FCC Part 90 guidance for assignment of one channel per 50 active public safety users
5. Based on 20 year population growth projections for Gallatin County
6. Total 2025 users is approximated based upon projected Long Term portable radio inventory (plus 5% margin).

FIGURE 7-1
SCMIC
RADIO SITES

Legend

- ▲ Existing Sites
- ▲ Proposed Sites
- (V) Voted Receiver
- (TS) Transmission Steered

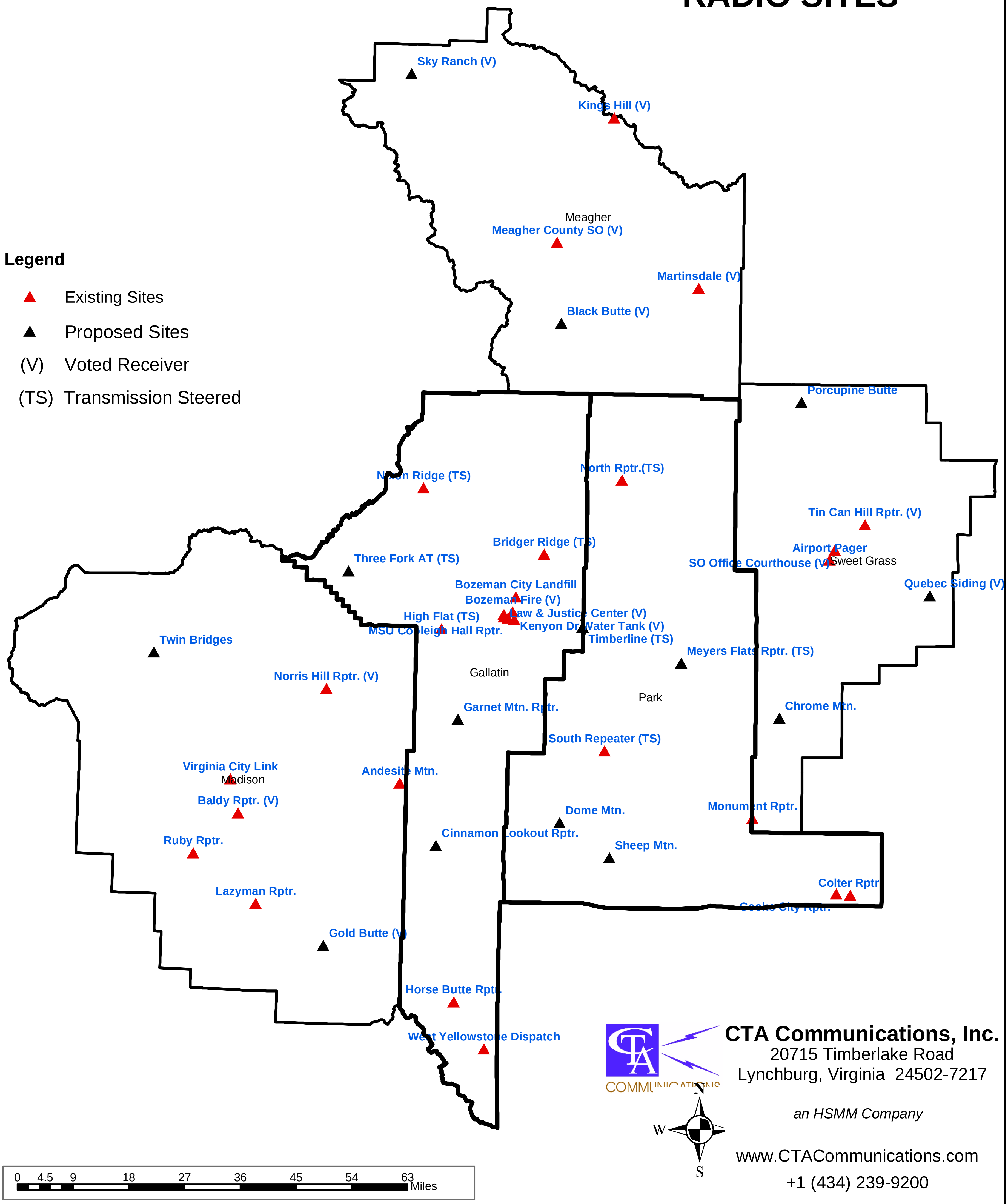

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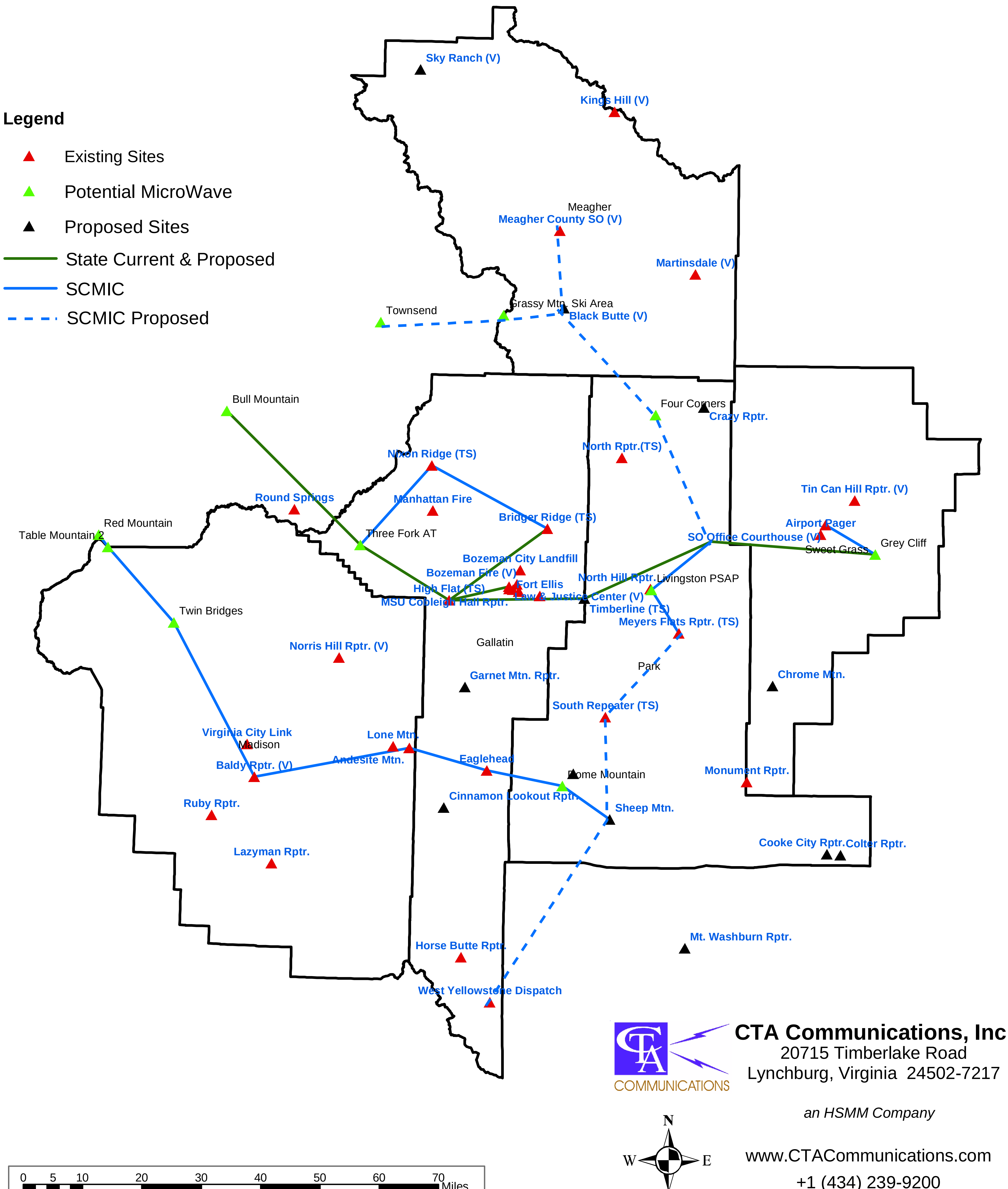
FIGURE 7-2
SCMIC
MICROWAVE PLAN



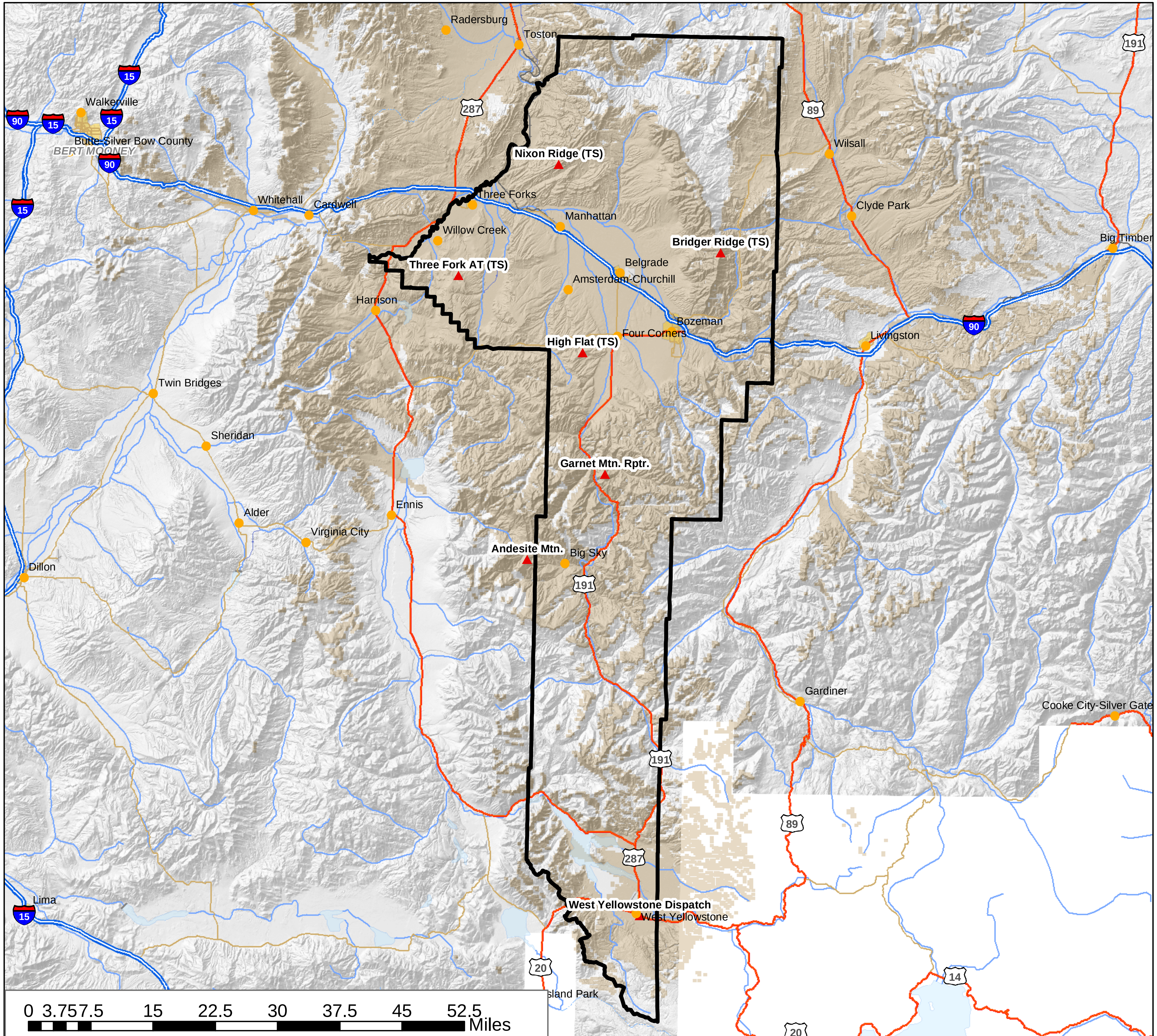


FIGURE 7-3
GALLATIN COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PAGER ON HIP
Sites: Bridger Ridge,
High Flat, Nixon Ridge,
Andesite Mt.,
Garnet Mtn. Repeater,
West Yellowstone Dispatch,
Three Fork AT

Agency: County Paging

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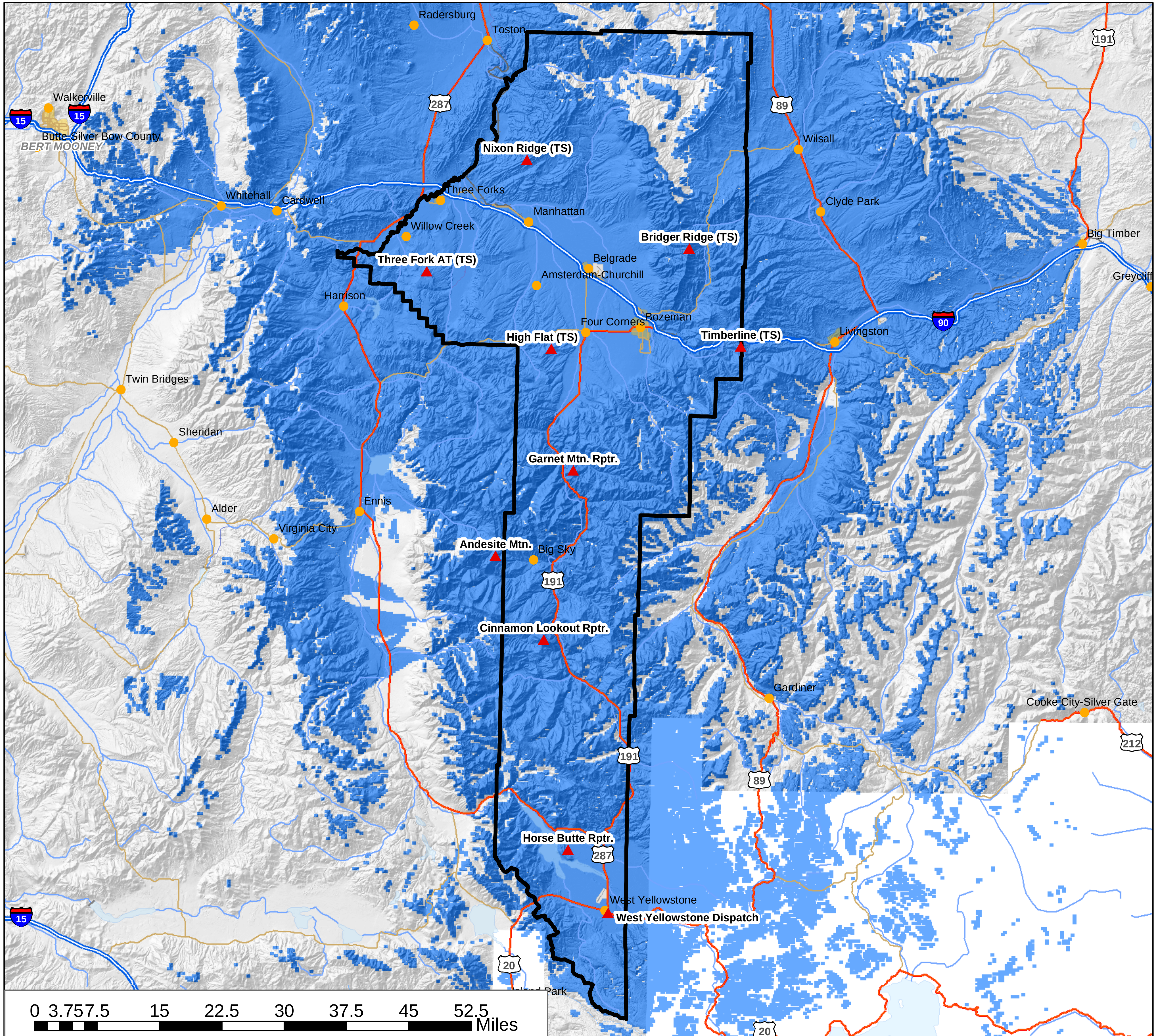

FIGURE 7-4
GALLATIN COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PORTABLE
ON HIP

Sites: Bridger Ridge,
Nixon Ridge, High Flat,
Garnet Mtn. Repeater,
Timberline, Andesite Mtn.,
Cinnamon Lookout Repeater,
West Yellowstone Dispatch,
Three Fork AT, Horse Butte

Agency: County Fire, Sheriff

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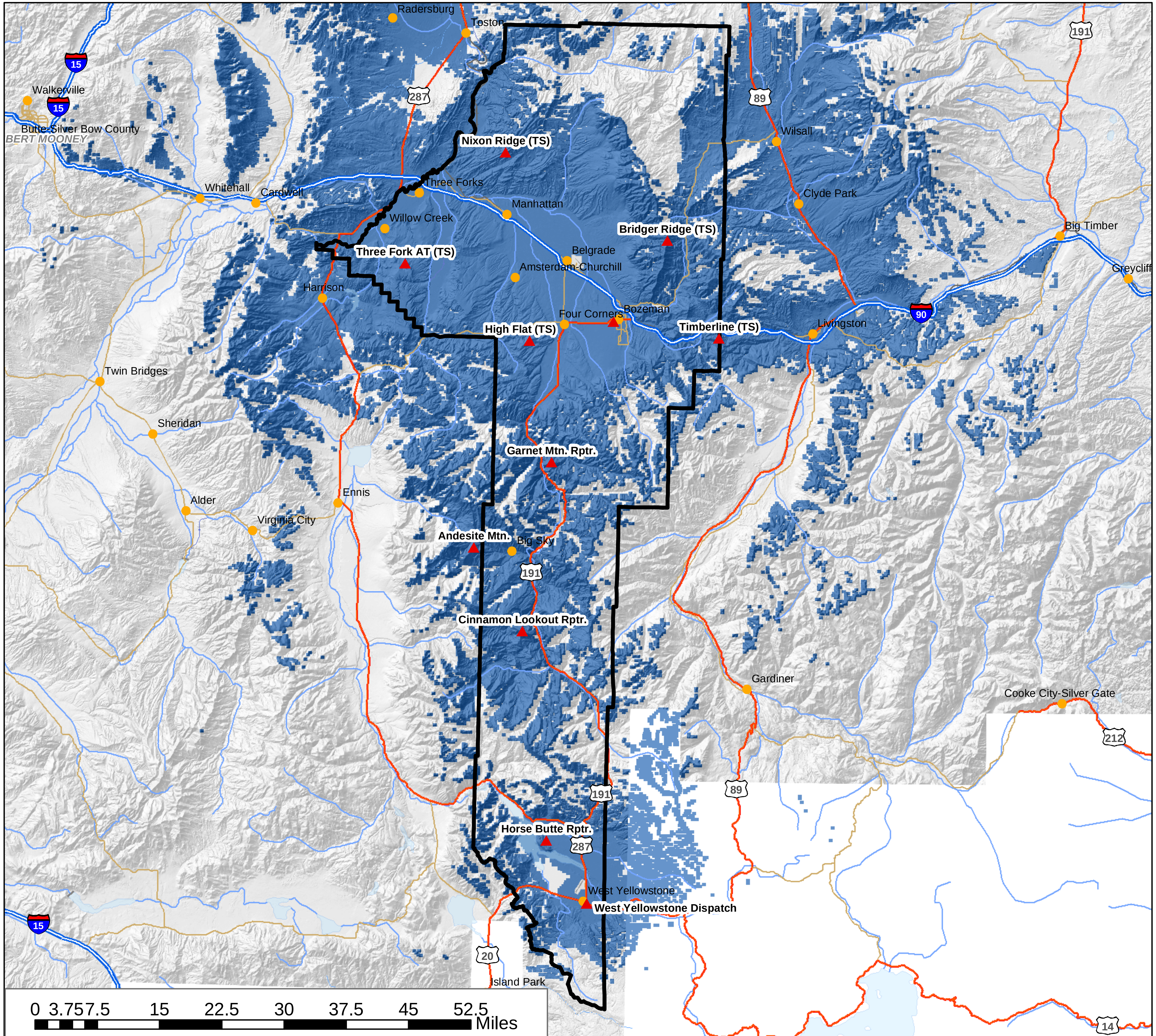

FIGURE 7-5
GALLATIN COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction
TALKIN FROM PORTABLE
ON STREET
Sites: Bridger Ridge,
High Flat, Nixon Ridge,
Andesite Mtn., Horse Butte,
Garnet Mtn. Repeater,
Timberline, Three Fork AT,
Law & Justice Center,
Cinnamon Lookout Repeater,
West Yellowstone Dispatch
Agency: County Fire, Sheriff

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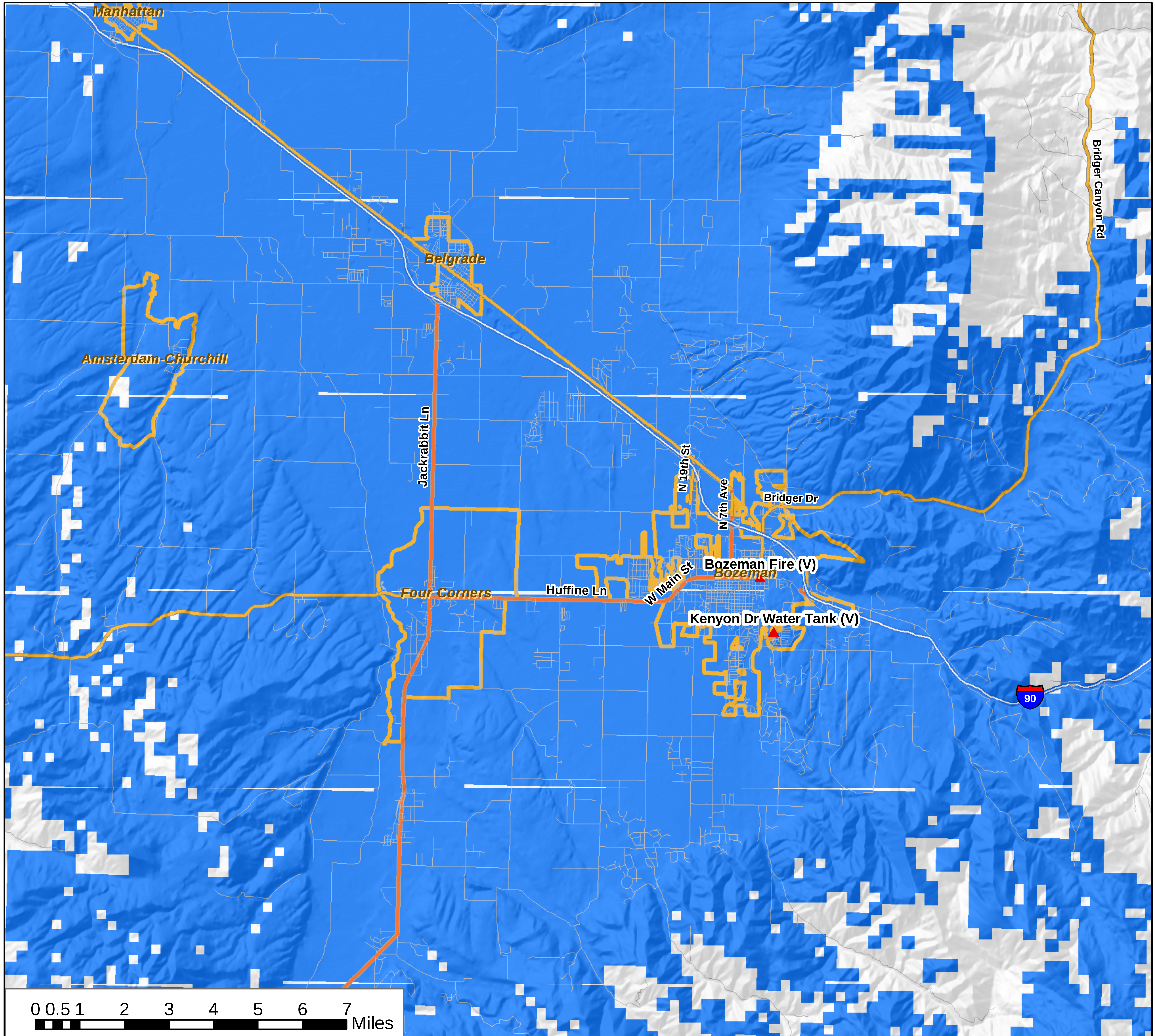

FIGURE 7-6
GALLATIN COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PORTABLE
ON HIP
Sites: Kenyon Drive Water Tank, Bozeman Fire

Agency: Bozeman Police, Fire

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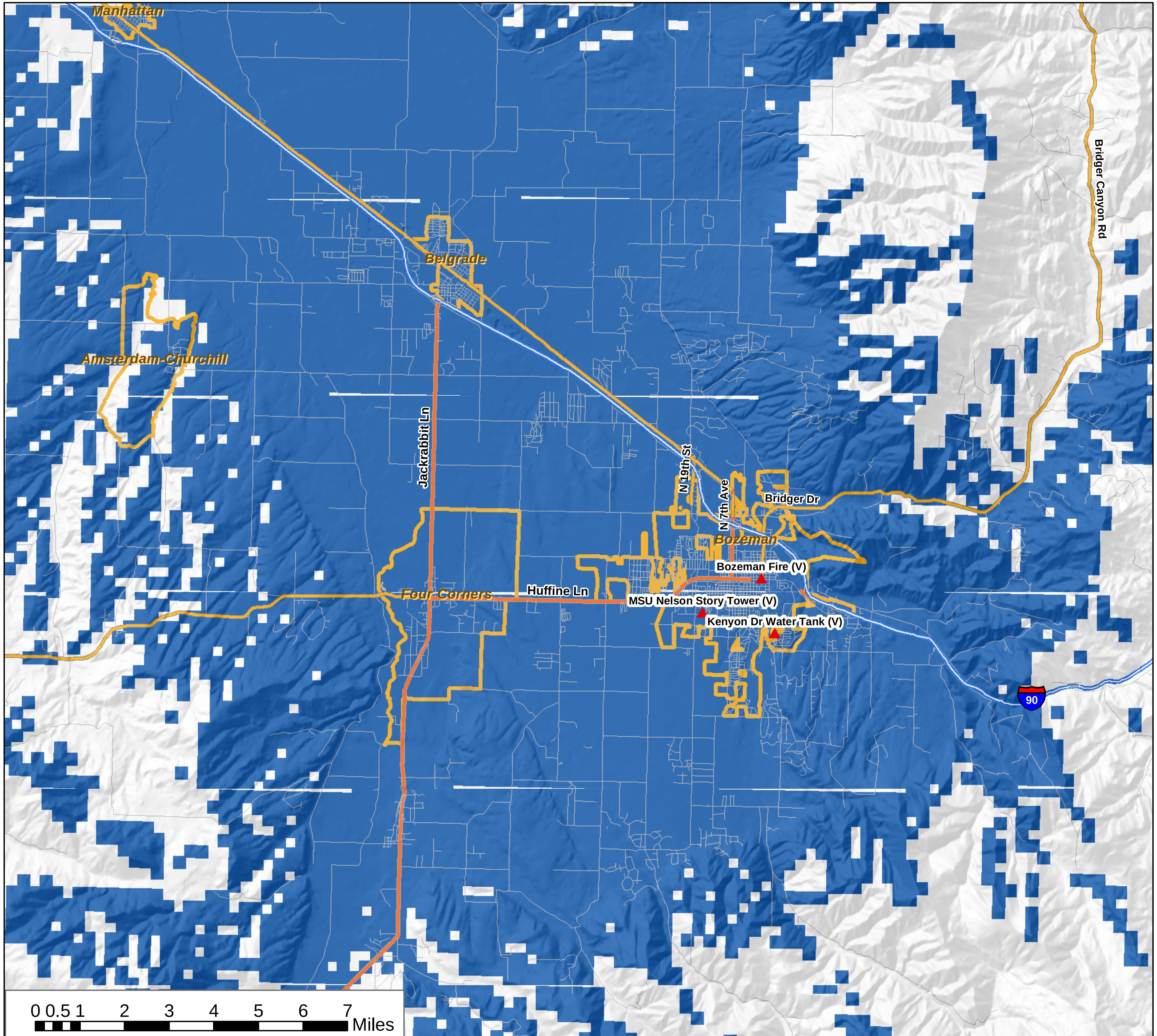

FIGURE 7-7
GALLATIN COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKIN FROM PORTABLE
ON STREET
Sites: Kenyon Drive Water Tank,
Bozeman Fire,
MSU Nelson Story Tower

Agency: Bozeman Police, Fire

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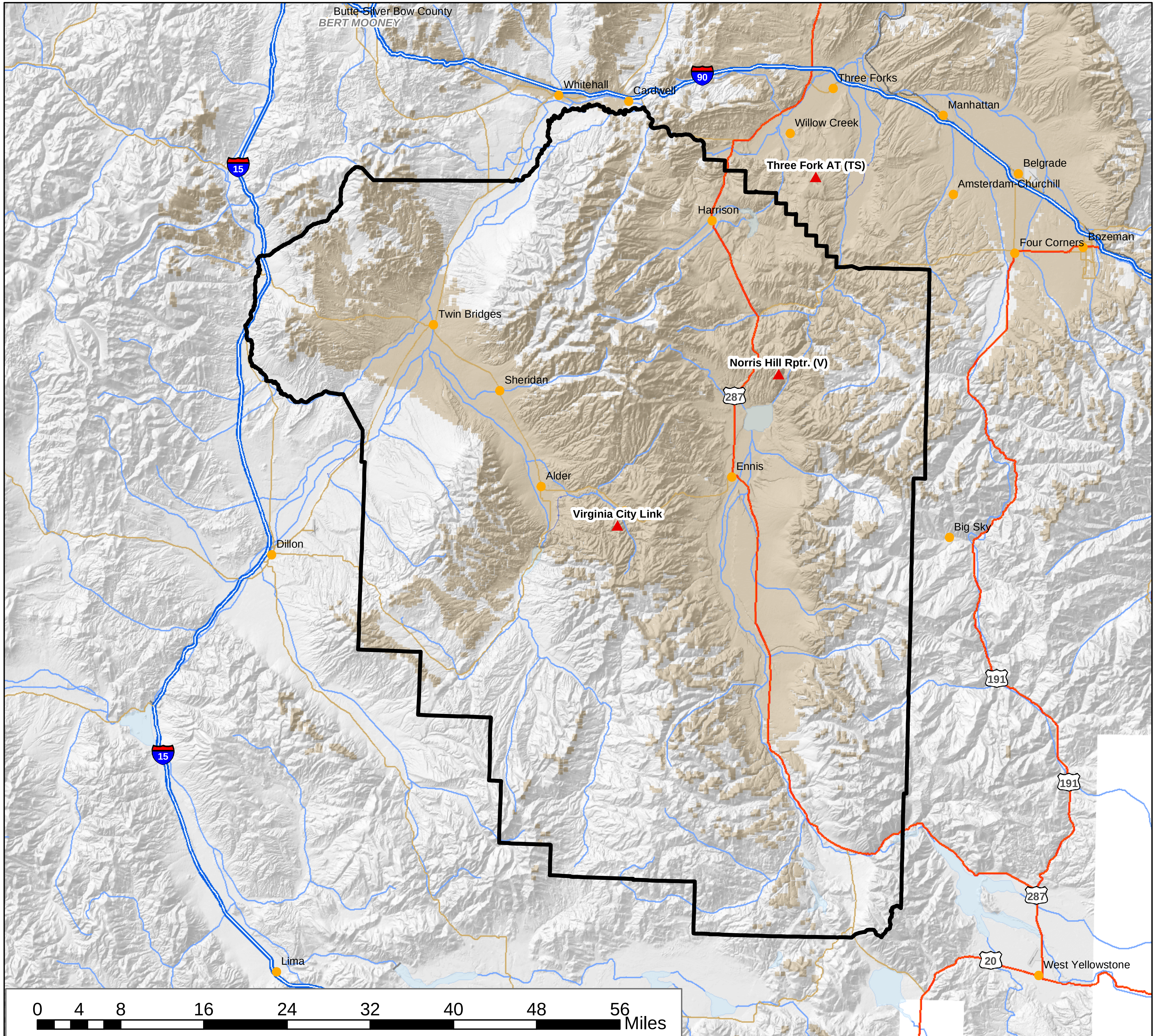

FIGURE 7-8
MADISON COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PAGER
ON HIP
Sites: Norris Hill Repeater,
Virginia City Link,
Three Fork AT

Agency: County Paging

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Madison Figure 7-8.PDF

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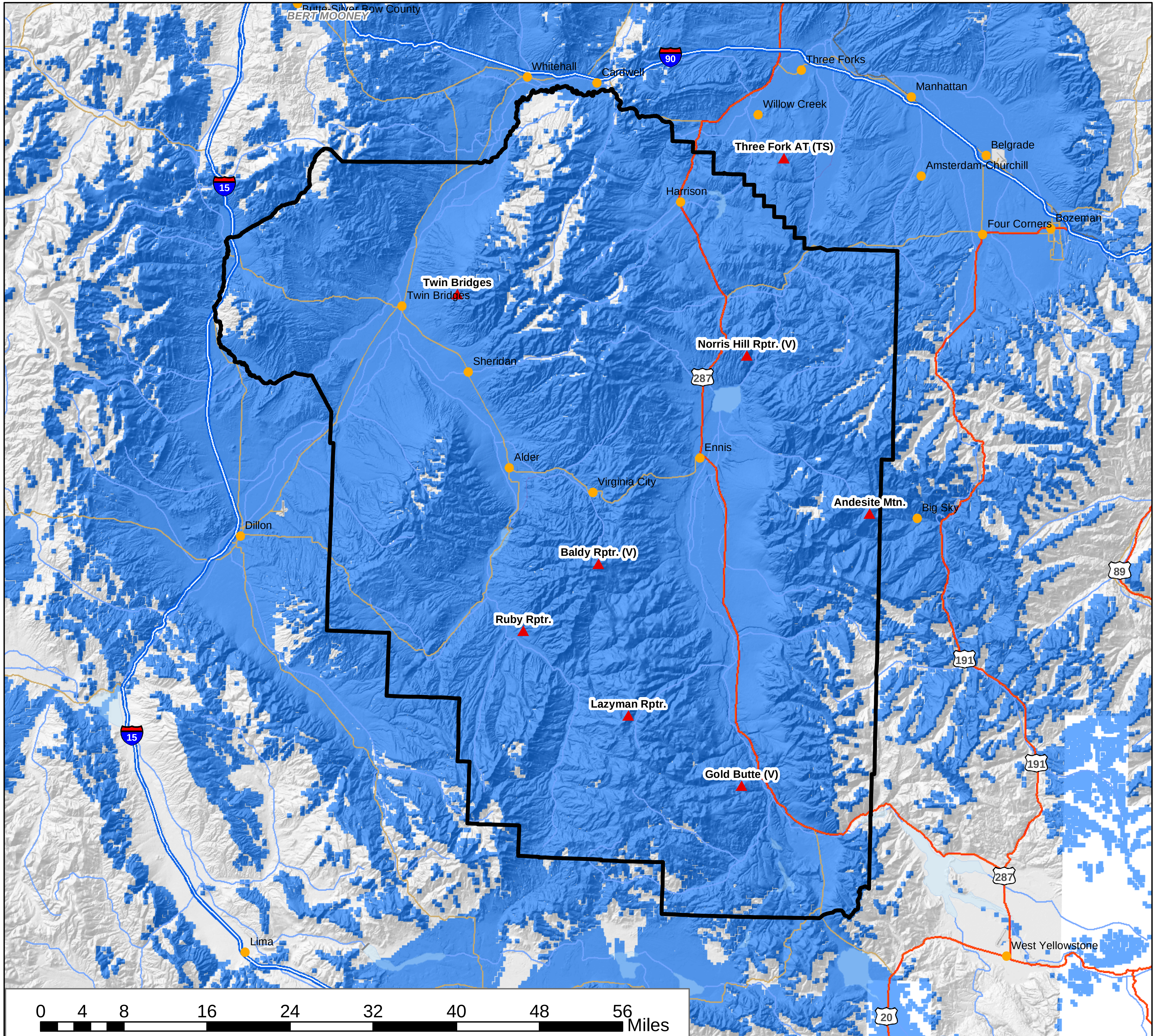

FIGURE 7-9
MADISON COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PORTABLE
ON HIP
Sites: Norris Hill Repeater,
Ruby Repeater,
Lazyman Repeater,
Baldy Repeater, Gold Butte,
Andesite Mountain,
Three Fork AT, Twin Bridges

Agency: Sheriff, Fire

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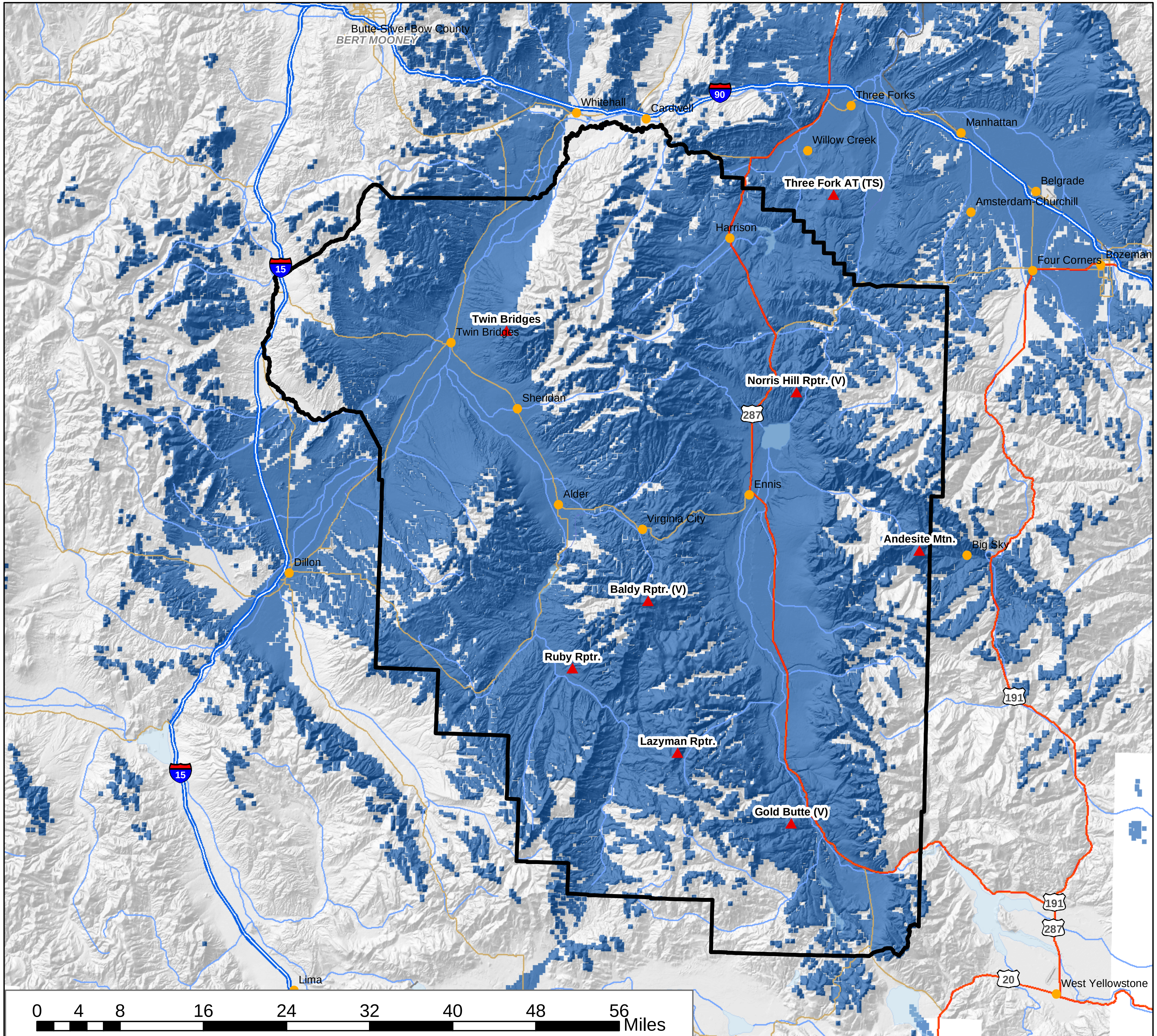

FIGURE 7-10
MADISON COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKIN FROM PORTABLE ON STREET
Sites: Norris Hill Repeater, Ruby Repeater, Lazyman Repeater, Gold Butte, Baldy Repeater, Andesite Mtn.,Three Fork AT, Twin Bridges

Agency: Sheriff, Fire

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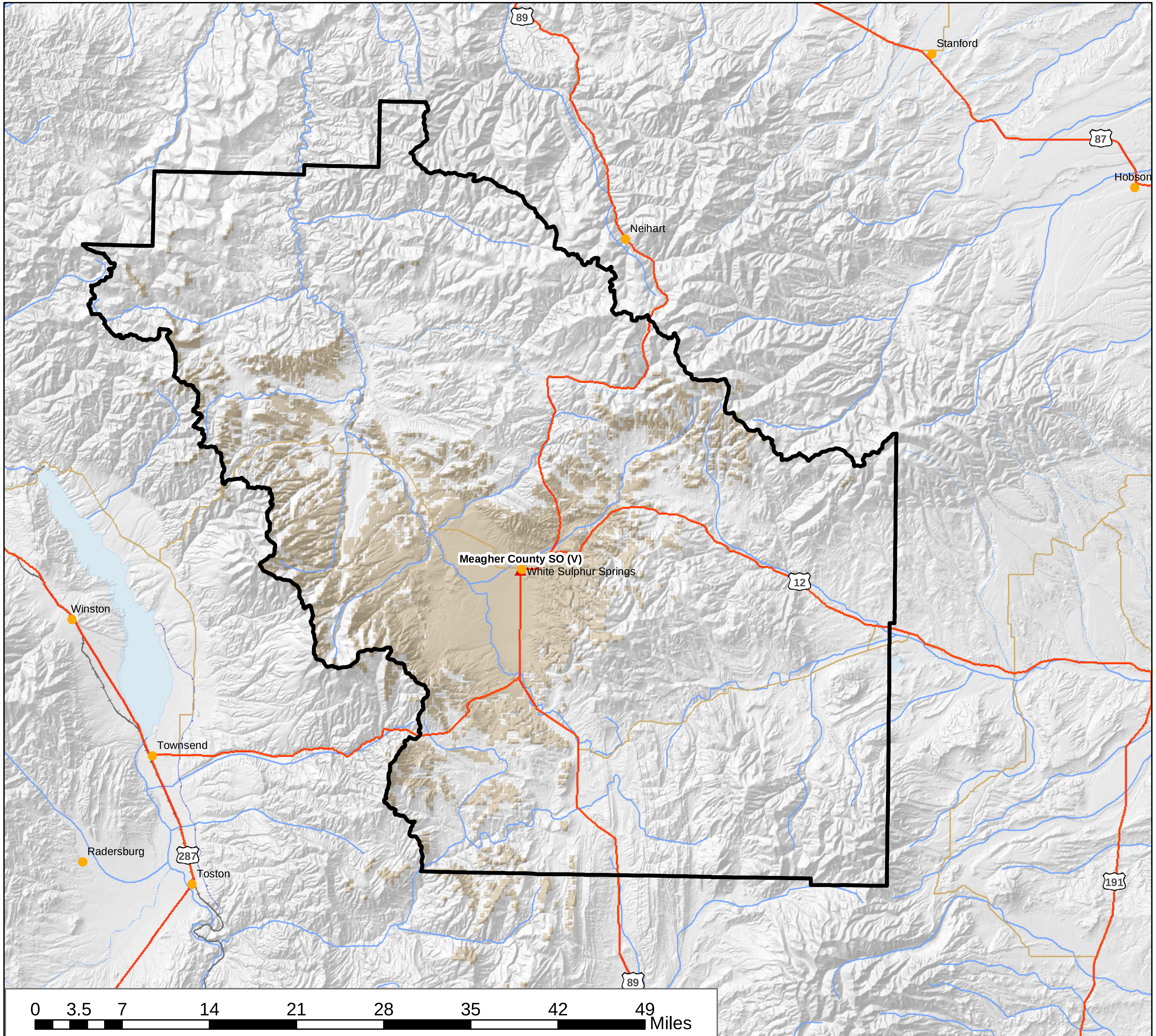

FIGURE 7-11
MEAGHER COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PAGER
ON HIP
Sites: Meagher County SO

Agency: County Paging

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Meagher Figure 7-11.PDF

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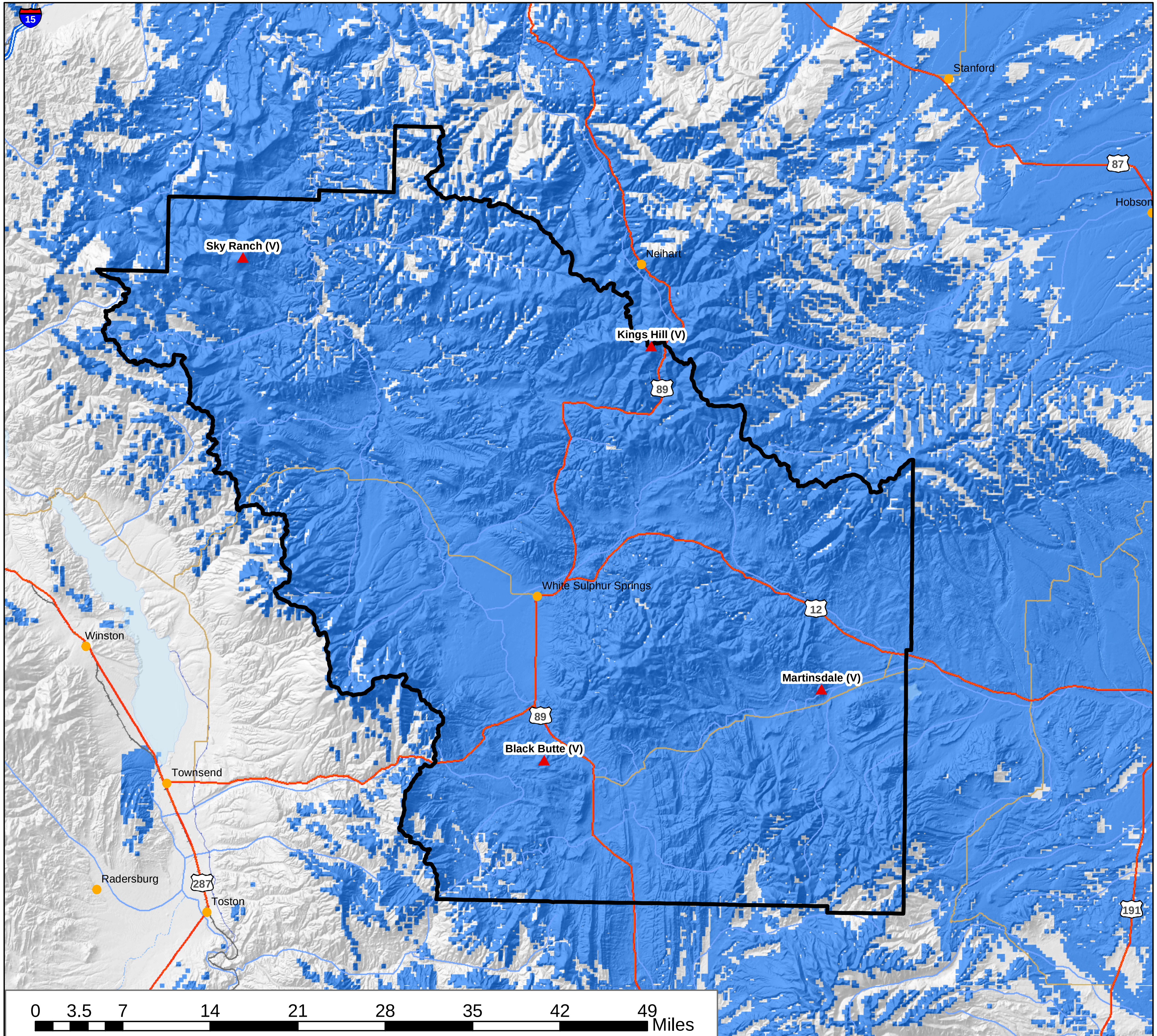

FIGURE 7-12
MEAGHER COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PORTABLE
ON HIP
Sites: Kings Hill,
Martinsdale,
Sky Ranch, Black Butte

Agency: Sheriff, Fire

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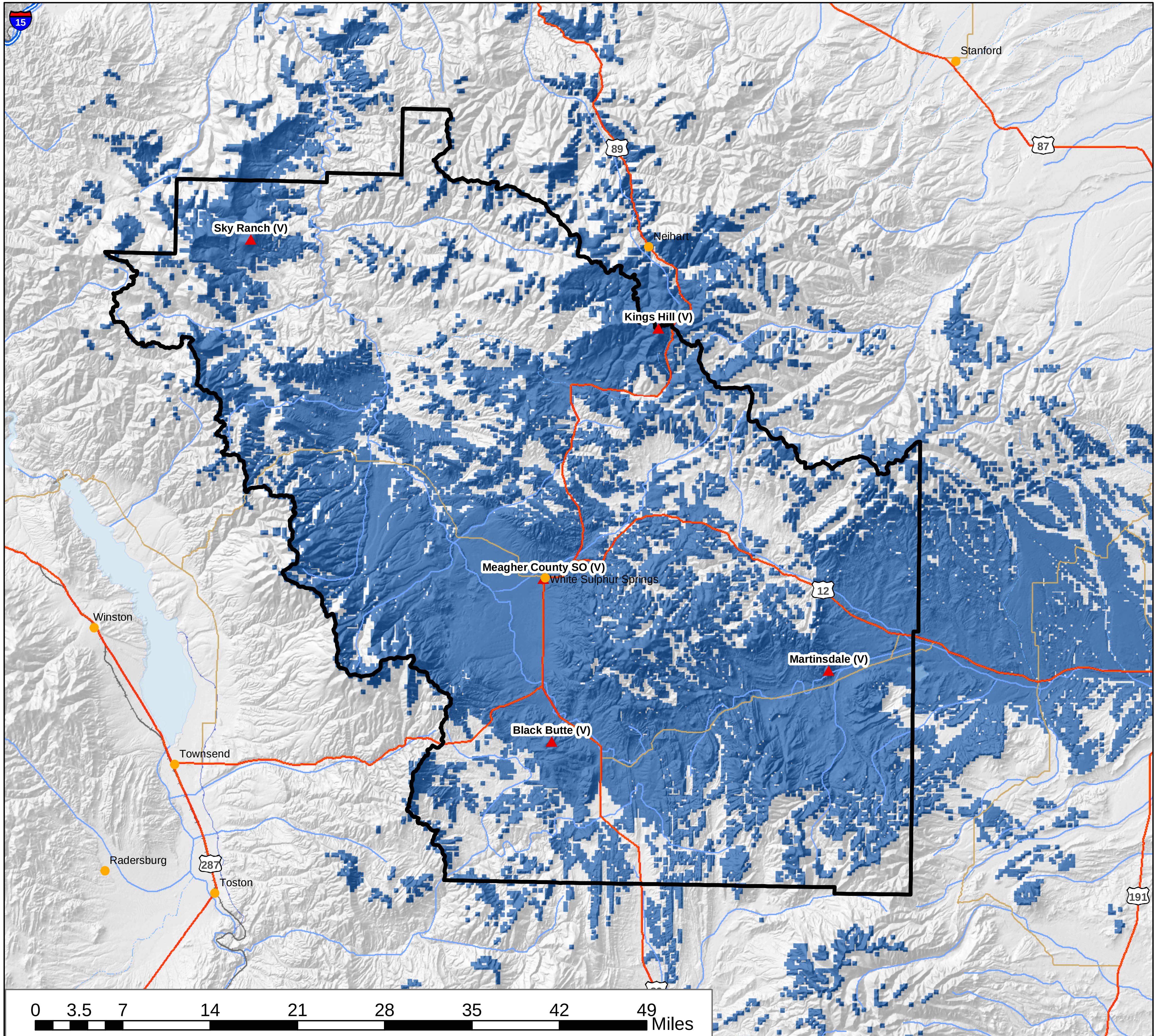

FIGURE 7-13
MEAGHER COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKIN FROM PORTABLE
ON STREET
Sites: Kings Hill,
Martinsdale,
Meagher County SO,
Sky Ranch, Black Butte

Agency: Sheriff, Fire

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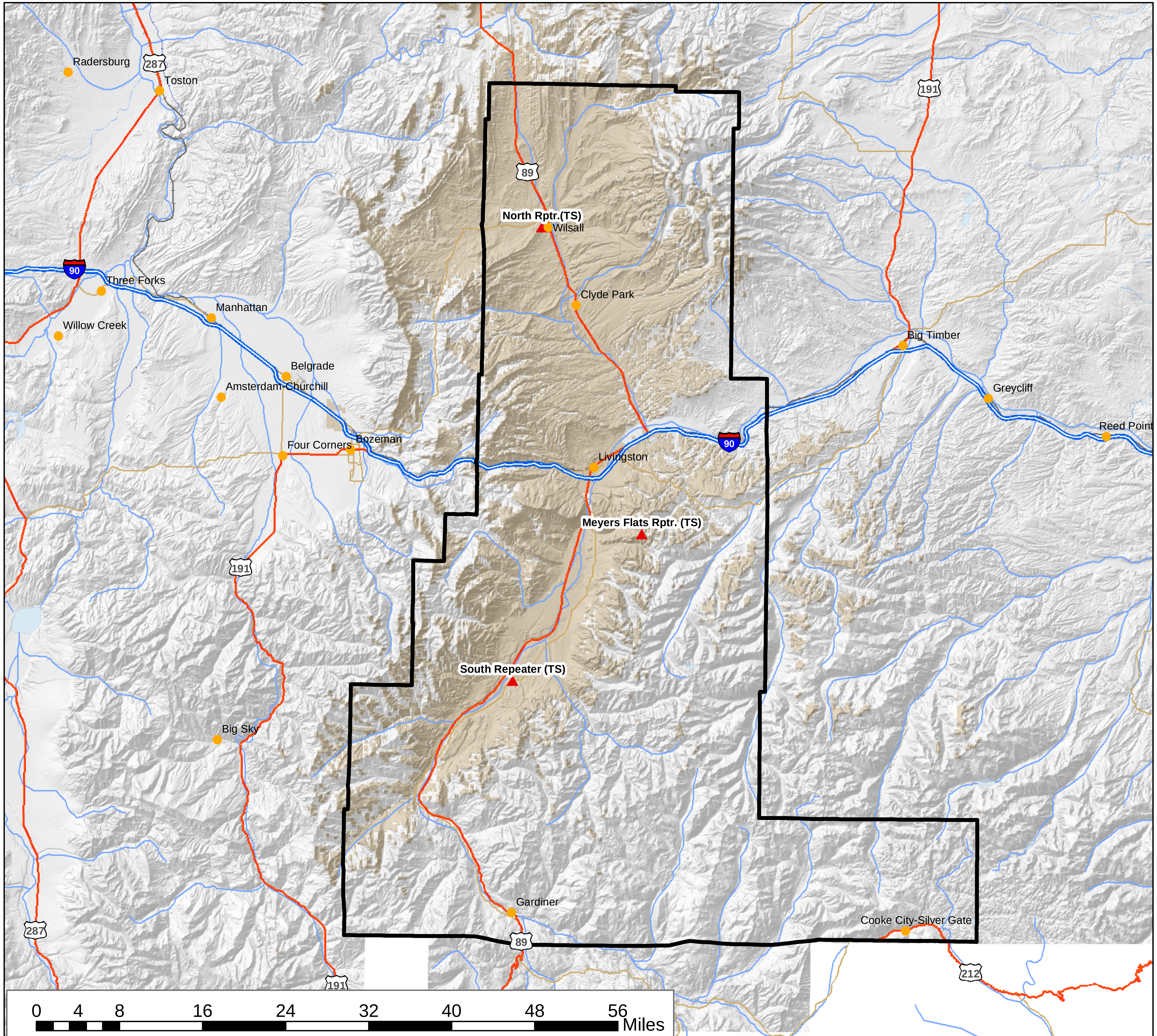

FIGURE 7-14
PARK COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PAGER
ON HIP
Sites: North Repeater,
South Repeater,
Meyers Flats Repeater

Agency: County Paging

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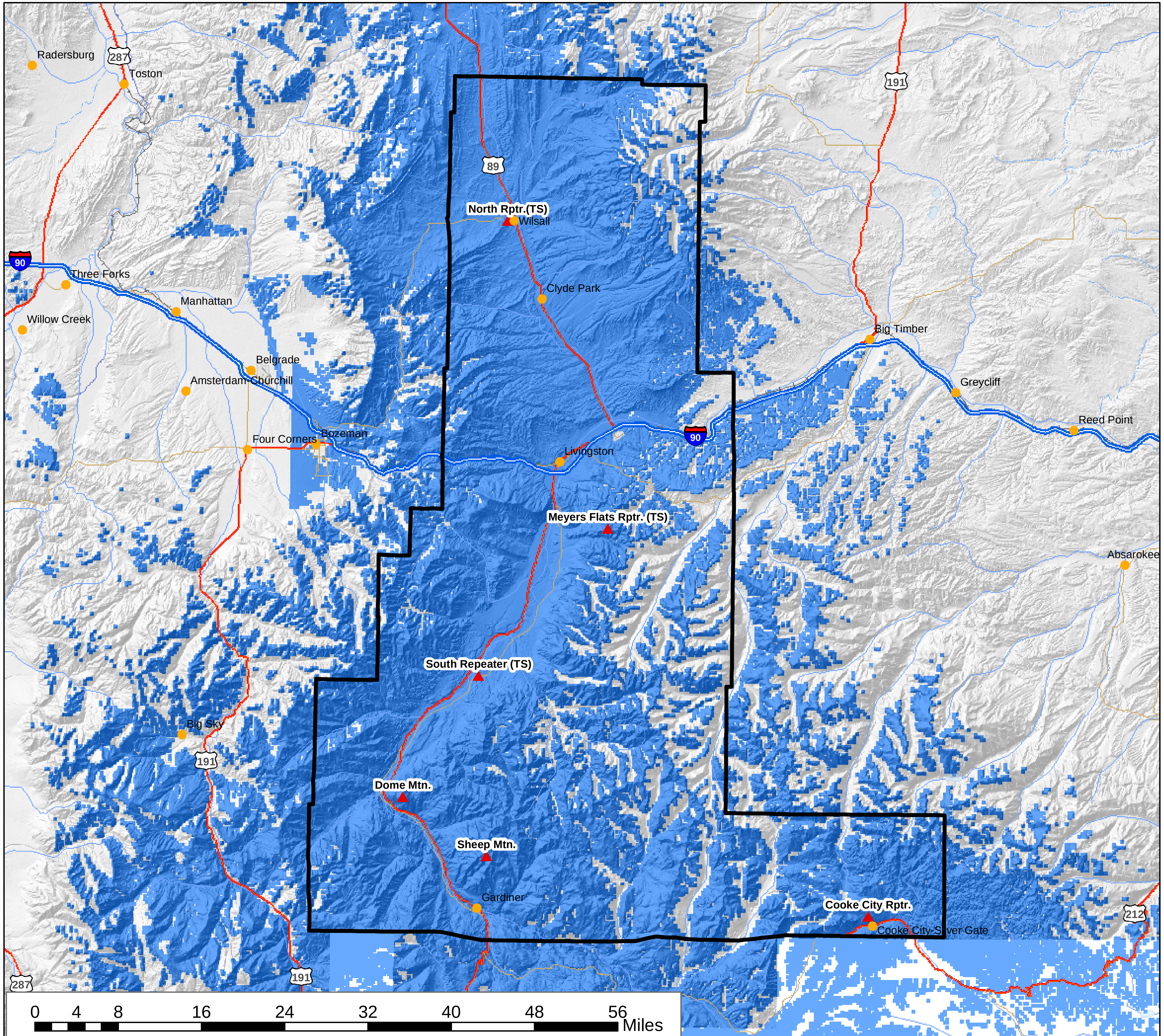

FIGURE 7-15
PARK COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO PORTABLE
ON HIP
Sites: North Repeater,
South Repeater,
Cooke City Repeater,
Meyers Flats Repeater,
Sheep Mtn., Dome Mtn.

Agency: Fire, Sheriff

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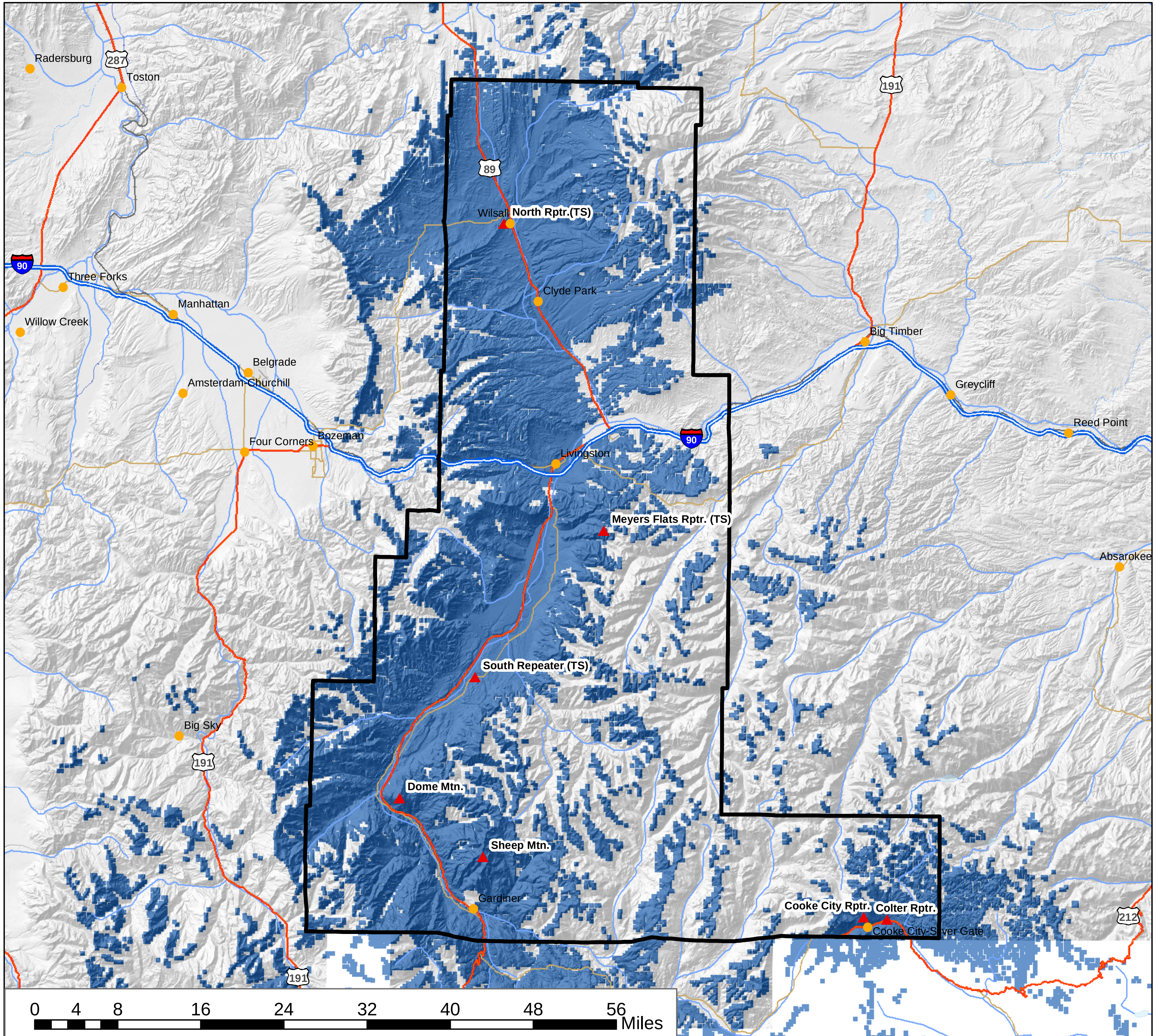

FIGURE 7-16
PARK COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKIN FROM PORTABLE
ON STREET
Sites: North Repeater,
South Repeater,
Cooke City Repeater,
Colter Repeater,
Meyers Flats Repeater,
Sheep Mtn., Dome Mtn.

Agency: Fire, Sheriff

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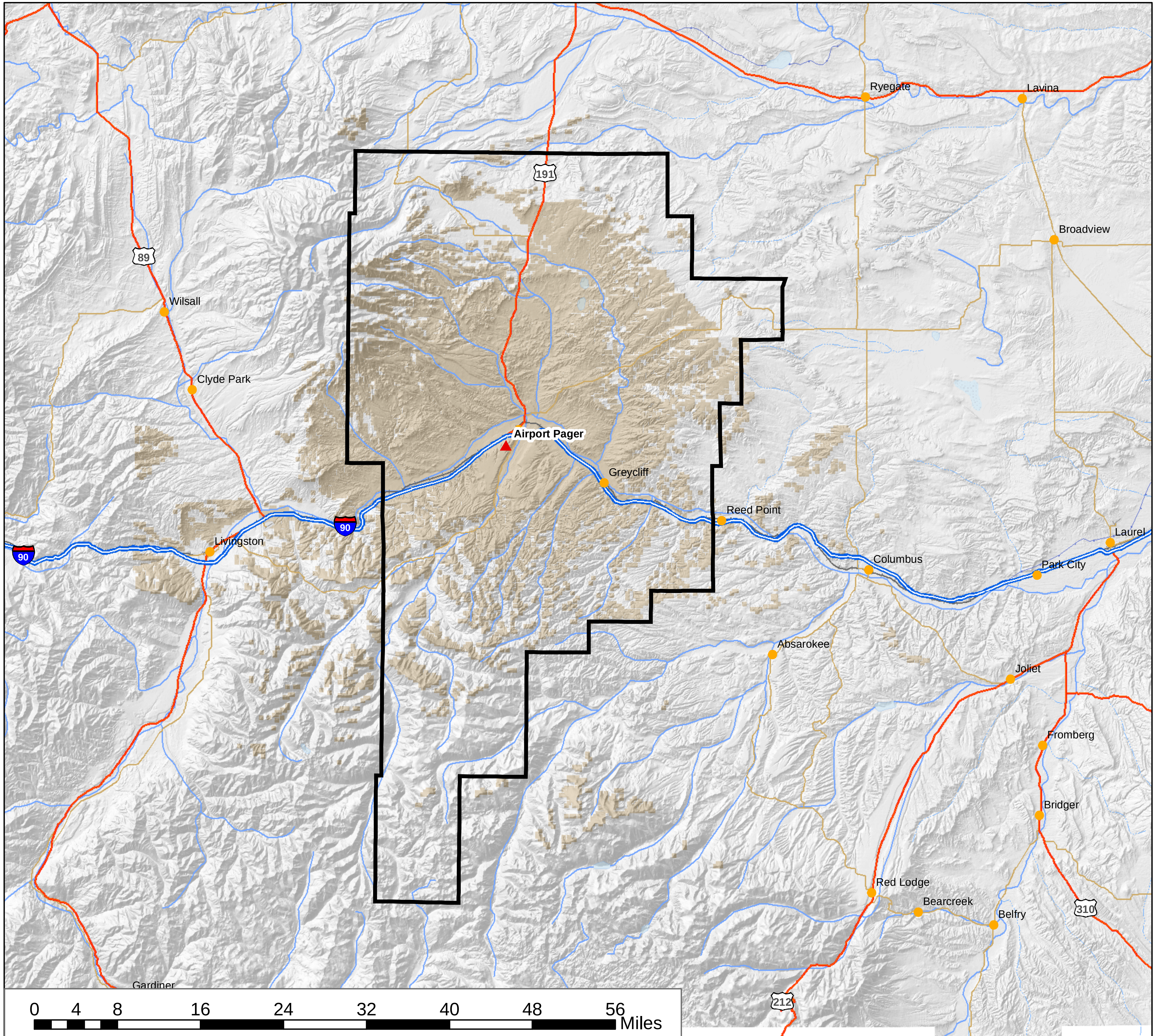

FIGURE 7-17
SWEET GRASS COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO
PAGER ON HIP
Sites:Sweet Grass Airport,

Agency: County Paging

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www.CTACommunications.com
+1 (434) 239-9200

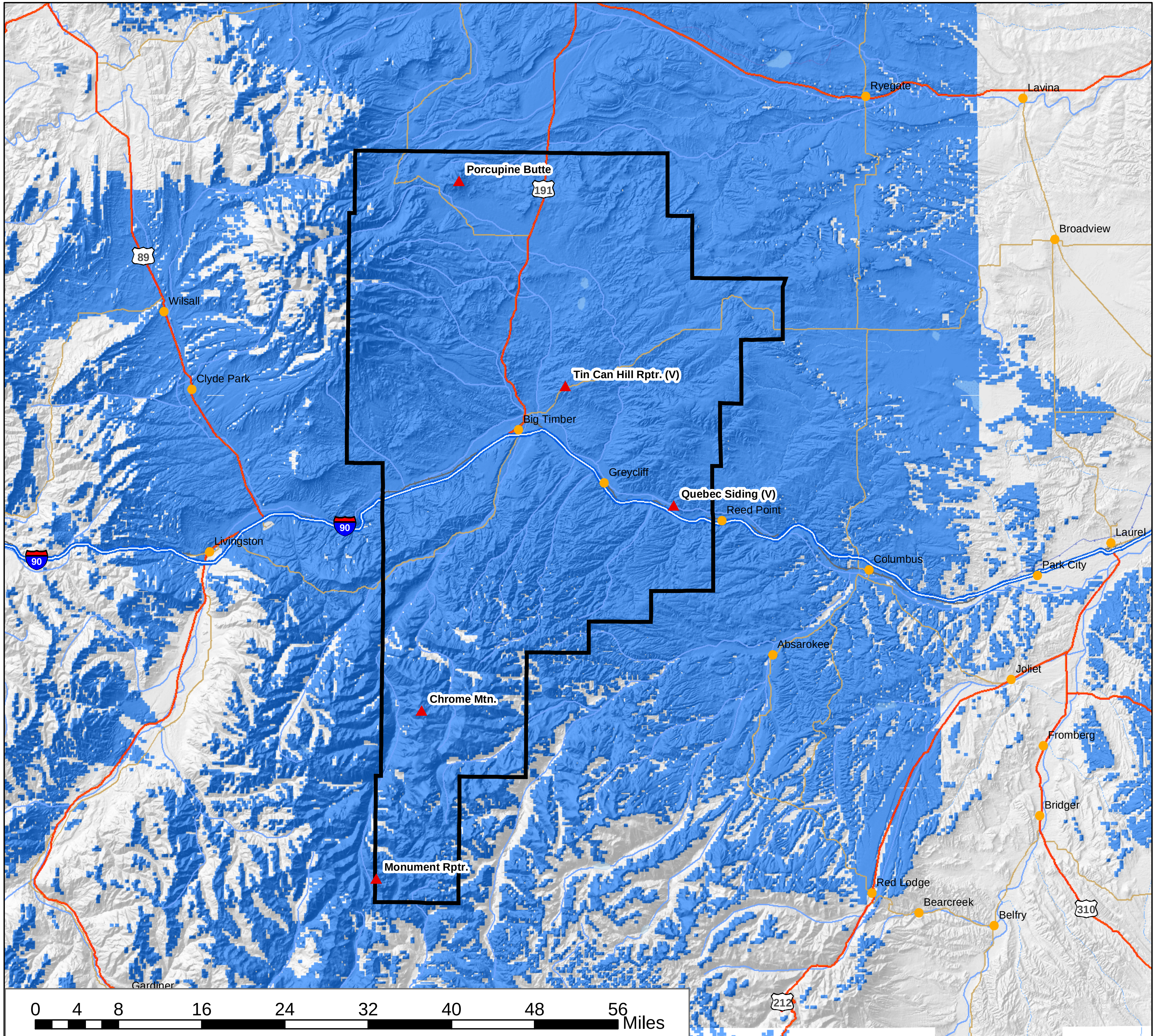

FIGURE 7-18
SWEET GRASS COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKOUT TO
PORTABLE ON HIP
Sites:Monument Repeater,
Tin Can Hill Repeater,
Quebec Siding,
Porcupine Butte,
Chrome Mtn.

Agency: Sheriff, Fire

Coverage displayed on this document is the result of predictive statistical modeling based upon client provided parameters and USGS geographical data. Actual coverage, as experienced by users in the field, may vary due to unknown and/or indeterminate variables.

Design: DRA 5/2/05
Drawn: TRM 7/25/05
Checked: DRA 6/06/05
Approved: DRA

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Sweet Grass Figure 7-18 rev1.PDF

Revised:

CTA Communications, Inc.
20715 Timberlake Road
Lynchburg, Virginia 24502-7217
an HSMM Company
www.CTACommunications.com
+1 (434) 239-9200

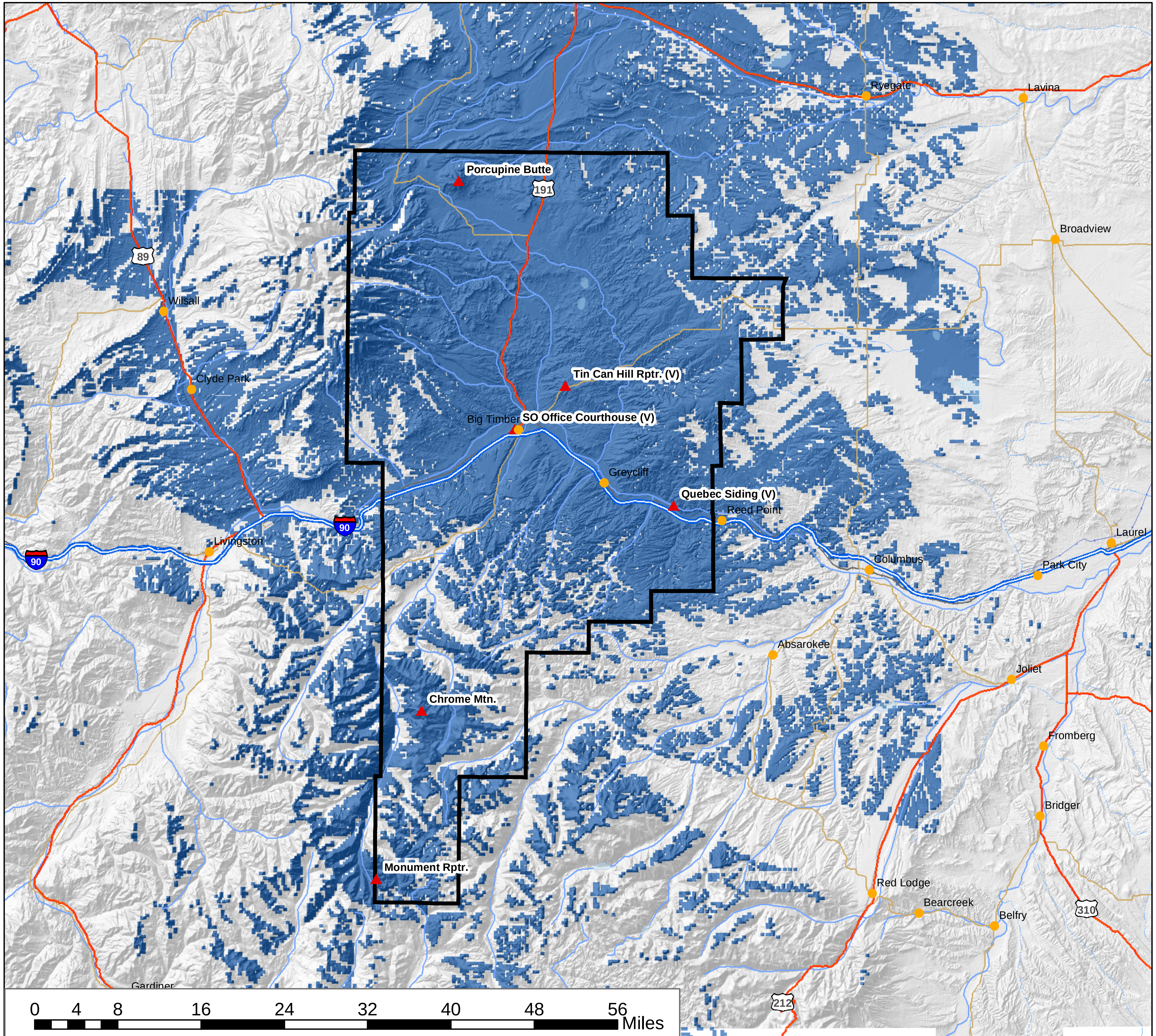

FIGURE 7-19
SWEET GRASS COUNTY
MONTANA

Client: SCMIC

Commission No. 20077

Proposed System Coverage Prediction

TALKIN FROM
PORTABLE ON STREET
Sites: SO Office Courthouse,
Tin Can Hill Repeater,
Monument Repeater,
Quebec Siding,
Porcupine Butte,
Chrome Mtn.

Agency: Sheriff, Fire

Coverage displayed on this document is the result of predictive statistical modeling based upon client provided parameters and USGS geographical data. Actual coverage, as experienced by users in the field, may vary due to unknown and/or indeterminate variables.

Design: DRA 5/2/05
Drawn: TRM 7/25/05
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Sweet Grass Figure 7-19 rev1.PDF

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8.0 SUPPORT

8.1 System Maintenance Considerations

Presently, the maintenance activities for SCMIC communications systems and electronics equipment are handled by Mountain Communications and Bridger Communications. These local radio shops are responsible for upkeep and repair of numerous equipment and systems, including:

A. Radio and paging system fixed equipment

B. Radio and pager non-fixed units installation and maintenance

C. Emergency Communications Center equipment, consoles, etc.

The recommended radio system improvement consists of sophisticated state-of-the-art digitally controlled communications equipment. A program of preventive maintenance would be essential to keep it running dependably. Maintenance shop personnel would require special training, and additional personnel with expertise in other disciplines may be necessary.

Since the SCMIC Counties do not currently have communications maintenance facilities, it would make sense to continue contracting to one or more qualified radio service shops for the maintenance of fixed system equipment. CTA Communications recommends this approach. Each shop's maintenance personnel should be experienced, generally well-trained, and qualified in their jobs. They should also be capable of readily learning new technical information.

Specifically, the selected service shop would need to train their people to be able to handle the newer technology. The selected service shops would only take this step with a firm commitment from SCMIC. Once this is done, those shops would effectively be "locked into" the contract and SCMIC would not be able to competitively procure services. Under a non-competitive situation, SCMIC would need to have a very well-worded and strong maintenance contract in place as part of the initial procurement, one which would put the burden on the equipment manufacturer to guarantee the availability of adequate service for the life of the system.

A greater portion of the maintenance effort should be allocated to systems-type work, including a program of proactive or preventive maintenance essential in keeping the system operating. This proactive maintenance would be offset somewhat by a reduction in reactive maintenance, since many potential problems will be detected and corrected before field failure occurs. We also suggest that agreements with the shops include workmanship standards. Higher standards can results in lower lifecycle costs. Qualified SCMIC personnel should become more involved in maintenance oversight to ensure that new standards are adhered to.

8.2 Staffing and Training

8.2.1 Staffing

The following categories of personnel are affected by this project:

- Communications Engineers and Planners
- Radio System Management Personnel
- Administration and Training Personnel

SCMIC needs to ensure that sufficient management, administration, and technical maintenance structure is in place in each County and able to address two-way radio operations and maintenance issues. Some or all of the positions described below may already be in place under similar or different titles. We envision the following SCMIC radio support structure:

A. Two-Way Radio Communications Planner: Works with other counties to coordinate radio usage plans. Develops channel and talk-group plans for all agencies for the home county and possibly other counties. He/she should have systems capability and experience as well as being capable of developing radio, console, and paging databases and programming files for cross-agency distribution. Also takes the lead for initial and ongoing training.

B. Communications Supervisor: Technically inclined, but not necessarily technically trained. Needs to be diplomatic and capable of addressing political concerns between SCMIC agencies and Counties.

These responsibilities could be effectively assumed by the dispatch operations supervisor or analyst.

C. System Technicians: Sufficient personnel for 24-hour staffing of the system programming equipment. This could be the Communications Supervisor described above backed by dispatchers on the evening shifts. The local service shops could also play a role in this function.

8.2.2 User/Operator Training

To make the SCMIC radio users knowledgeable and comfortable with their communications tools, formal user training (for field radio users as well as dispatchers) will be an important requirement of the proposed radio system improvements and expansions. Currently, the training of new SCMIC radio users occurs mainly as on-the-job training. Consequently, some radio users do not understand the basics of radio theory and usage, and they do not understand the relationship between base stations and coverage areas. Confusion or lack of understanding about the radio system may give the users a false sense that the equipment is not working properly, when in fact it is working as originally designed.

System improvements including new channels, reorganized channels, wide area coverage technology, digital operation, encrypted operation, and other changes will impact both the radio user and dispatch communicators. Dispatchers should understand the field user's environment, and to some extent, field personnel should understand dispatch.

Training programs need to have an element of continuing education built in. This should include incentive for demonstrating increased understanding of communications system along with other aspects of the user's job. As the sophistication level of your systems increase, you cannot rely on-the-job radio training for your new employees.

8.3 Regional Coordination

Even while meeting the Montana goal of equipment interoperability, variations in technology across consortia will exist. This necessitates personnel that understand the technical differences and ensure readiness for cross-support. In much the same way mutual aid channels are coordinated, increasing there will be a need for people that can plan and test interoperable equipment on slightly different types of infrastructure.

9.0 FACILITIES

We are recommending that SCMIC take advantage of this expanding communications environment to 'share' sites with other users. It may be possible for the County to partner with other counties, other consortia, and other agencies to share and reduce the expenses of a radio site. We recognize several site-sharing opportunities between SCMIC Counties, other consortia, and the federal USFS, USPS, and BLM agencies. If successful, some of these will allow radio coverage in otherwise inaccessible areas.

What follows in this section is a description of the recommended characteristics of a radio site. Each site used, whether existing or new should be envisioned with the following features. Each existing site to be used in the new radio system will require varying degrees of upgrading. The following issues are addressed for existing radio sites and new sites:

A. Site Development

B. Equipment Enclosures

C. Emergency Generators and Site Power

D. New Towers

E. Alarms

9.1 Site Development

The following is a listing of elements which must be addressed for the upgrade of any existing radio sites or when designing and developing new radio sites:

A. In general, the site should be clean and properly cleared of vegetation. This includes grubbing and leveling of the area and providing a clearing of a 10-foot-wide path from any guyed towers to their guy anchor points.

B. Where practical, the site should be accessible to common pickup truck and SUV-type vehicles on a regular basis. The road must be in passable condition or capable of being repaired without undue expense.

We consider four inches of standard road paving gravel, such as #57 size aggregate to be an acceptable covering material and recommend it for all sites. We do not recommend any extensive grading, culverts, etc. The road should be able to be maintained free of washouts and dry, except possibly after heavy downpours. In cases of heavy downpours, it is acceptable for water to cover part of the road for a short period of time.

The area inside the equipment enclosure fencing should be covered with gravel. There should be ample room for parking and a turn-around area for two full-size pickup trucks.

For some sites, helicopter access may be needed under some weather conditions. We suggest including the development of a helicopter landing area in the site development plans.

C. Foundations for the equipment building, emergency generator, and for the tower and guy anchors would be required if new shelters and/or towers are installed.

D. The system vendor will be required to provide a structural and wind loading analysis of existing towers, antenna structures, and foundations with his equipment mounted on them to determine if they are acceptable. If the loading is not acceptable, the tower or antenna structure will have to be replaced or strengthened. All new towers will be specified with extra loading capability for future antennas.

E. Fencing is needed to enclose the site and to enclose the guy anchor points individually where a guyed tower is utilized. Any existing fencing should be rust-free, in good repair, well grounded, and have a double gate. Access to the fenced radio site shall be regulated using locking devices.

F. Geotechnical investigations, including borings for tower foundations, shall be performed before designing and building any new towers or other structures. The Owner customarily provides these studies.

G. The grounding system at a radio site must consist of the following:

- Halo ground system inside building
- Buried ground system for building and tower
- Tower and fence grounding equipment

- Ground rods and test wells
- Surge suppression devices
- PolyPhasor-type bulkhead feedthroughs

9.2 Equipment Enclosures

Varying degrees of improvements will have to be performed, which may include part of the following.

A. The equipment building or room must be of sufficient size to hold the radio plus provide room for any future expansion. The building or room must be in good condition and provide protection to the equipment from vermin and water damage. In the event that new shelters are needed, we recommend pre-fabricated enclosures, which are currently furnished by several manufacturers. This type of building represents the best economic alternative to on-site construction, which is generally more expensive. The enclosures would be delivered to the site fully assembled with electrical wiring and lighting already installed. Access to the equipment enclosure shall be regulated using locking devices.

B. Sufficient fire suppression equipment is needed at each site to limit the loss of equipment in case of fire. Fire or smoke detection and security equipment must provide notification to operators of an emergency or intrusion. An automatic release of fire suppression agents should occur at unmanned remote radio sites or facilities.

C. The heating, ventilation, and air conditioning (HVAC) system must be capable of accommodating the equipment’s heat dissipation. Dual-redundant HVAC units are recommended for each site because of the sensitivity of the radio equipment to fluctuations in temperature and humidity.

D. A twenty-five pair telephone termination must be brought into new and existing shelters for termination of alarm and control wiring.

E. Some sites must be designed for heavy snow conditions. This may include alternate shelter entrances and protection for antennas such as microwave dishes that are sensitive to snow cover. In case of unexpected weather conditions and for service worker safety, emergency food/water rations and a first aid kid should be provided at remote sites.

9.3 Emergency Generators and Site Power

The main power transformer at each site must have adequate size and be in good condition. Transformer sizes at existing sites must be able to accommodate the increased heating and building loads. There should also be an emergency generator sized for the entire load in case of a power outage on the main feeder. We usually specify outdoor generators with weatherproof enclosures and block heaters where generators do not exist or are not acceptable. To ensure glitch-free power to sensitive computer controlled radio equipment, uninterruptible power supplies (UPS) will be required for all fixed network equipment. DC power with ample battery back-up will be used for some classes of equipment or for some locations where AC power back-up is impractical.

Where commercial power feeds are infeasible, alternatives such as solar power systems can be used. We suggest installing bullet resistant walls to protect expensive solar panels against vandalism.

9.4 New Towers

New towers may be needed to replace structures which are incapable of holding the antennas necessary for the new radio system. We envision continued use of the relatively short types of towers commonly in use on the open high-elevation sites. All new towers will be specified with extra loading capacity for future antennas.

9.5 Alarms

CTA Communications recommends that a comprehensive alarm system be installed for each of the facilities that are linked into the network. The recommended digital radio equipment and paging system enhancements will have additional alarm and status signals that should be monitored. Equipment and facility alarms should be wired to a local enunciator (non-audible, light only) at each site and also be sent back to the communications center. The following alarm points are recommended:

A. Intrusion alarm from door switch
B. Building temperature alarm
C. Generator fuel level alarm
D. Automatic transfer switch alarm

E. Generator abnormal alarm
F. Generator run alarm
G. Loss of utility power supply
H. Charger failure
I. DC bus voltage
J. UPS alarm
K. HVAC alarm
L. Tower lighting alarm
M. Fire suppression system deployment
N. Spare alarm points

Note: An integrated alarm system for radio and site alarms is also acceptable. The selected vendor should recommend an alarm scheme categorizing alarms transmitted to the consoles as either major or minor. The vendor should present the alarm scheme as part of their overall proposal.

10.0 REGIONAL INTEROPERABILITY ESTIMATE OF PROBABLE COST

Estimates were developed for the major categories of equipment as described in the interoperability design for the SCMIC community. The unit cost information is obtained from historical CTA cost files and vendor pricing for comparable projects. The various costs are compared and weighted in order to derive an average type of estimate.

Estimates reflect expected average pricing. The average prices are recommended for planning and budgetary purposes. Although CTA cannot guarantee bid price levels, successful competitive bidding typically results in savings on the price costs, especially in the area of radio equipment.

The estimates are provided for a functional system. The estimates include:

Infrastructure - Installation, cabling, antenna systems, combiners and multicouplers, vendor services, spares, and one year's warranty.

Sites - Installation, wiring, initial fuels, vendor services, and one year's warranty

Microwave or Interconnectivity - Installation, cabling, antenna systems, dish alignment, vendor services, spares, and one year's warranty.

Consoles - Installation, cabling, antennas, initial programming, and one year's warranty

Mobiles and Desk Top Radios - Installation, cabling, antennas, initial programming, and one year's warranty

Portables - Initial programming, two batteries, one shoulder microphone, a carrying pouch or belt clip, a desk charger, and one year's warranty.

Mobile Data Infrastructure - Installation, cabling, antenna systems, combiners and multicouplers, vendor services, spares, and one year's warranty.

Mobile Data Field Units - Installation, cabling, antennas, initial programming, and one year's warranty.

Project Management Independent Verification and Validation - This includes services to oversee the implementation of the various systems and to check the installation and verify proper operations and performance.

There are five Regional display tables included here. The first is for Immediate costs which includes certain site improvements that are imperative for the five counties to implement prior to the coming fire season. Also there are a number of subscriber portables to ensure that all agencies can communicate with the US Forest Service prior to this fire season as well. The next four are for Near Term, Mid Term, Long Term, and Far Term consolidated costs for the recommended improvements for the entire SCMIC community. Each of the five counties' estimates are further broken down and included in SECTIONS 10.6 through 10.10 that address each county separately. All tables show unescalated costs in 2005 dollars, since we do not include a specific timeline for all of the phases.

CHART 10 - 1SCMIC Immediate Estimate

CHART 10-2 SCMIC Near Term Estimate

CHART 10-3 SCMIC Mid Term Estimate

CHART 10-4 SCMIC Long Term Estimate

CHART 10-5 SCMIC Far Term Estimate

10.1 Procurement Recommendations and Conclusions

While there are few system design “standards” for mobile radio systems, the typical approach for radio system engineering is to apply generally accepted practices used throughout the industry. This provides a level of "acceptability" for both the owner and for the consultant or design engineer. The typical framework for designing public safety radio systems recently has come from the TSB-88 document, a set of guidelines developed in the 1990s by a TIA working group.

This in general describes certain signal strengths and coverage levels as being "public safety grade". By adhering to the TSB-88 guidelines, the designer’s job is made easier since some of the design decisions are already made. No-one can fault the designer who uses TSB-88 as his or her baseline.

While we at CTA consider the TSB-88 guidelines in our designs, and we do believe that the SCMIC community should have a system that approaches that described in TSB-88 grade as a long term goal, we also believe the costs of initially implementing this type system will be excessive, and the actual operational improvements realized may not be commensurate with the price. The community can achieve great improvements in coverage and reliability using reduced designs that are more cost effective, and not out of reach financially. You will find that our recommendations are not designed to TSB-88 levels. But they do offer dramatic advances over the coverage you currently experience. We are recommending a series of improvements that while not "public safety grade" in every category as defined by TSB - 88, will provide workable and affordable solutions for your community. While there may be some risk to us in recommending a system that is "less than perfect", there is the very real risk for you that if the only recommendation we made was for a "perfect" system, it would be out of reach financially. It is our opinion that improvements that are "less than perfect" and are implemented are far superior to a "perfect, but unimplemented" system.

In general our SCMIC recommendations fall into the following categories:

Coverage improvements – before achieving interoperability on agency, county-to-county, and state levels, it is important to first be able to communicate where needed.

Equipment upgrades – many SCMIC participants have outdated equipment, or radios with insufficient channel capacity to allow operation on all potentially used neighboring channels or emergency channels.

Frequency Band – common frequency band improves near, mid, and long term interoperability - standardize on VHF for all two-way voice and data radio operations.

Join Statewide Trunking Systems - The eventual goal for the state is to have trunking radio interoperability throughout the state. The SCMIC region will benefit by joining this system. The actual application is expected to be a hybrid trunked system; with some trunking sites and some stand-alone sites in very remote areas. This process is being followed in other regions of the state. The SCMIC region would need to implement microwave connections to this state system. All in all this will provide added interoperability throughout the state.

Common Standards - standardize on P25 for Law Enforcement, and use AES for encryption. This gives law enforcement compatible, standards-based, and secure radio equipment which complies with Federal standards.

10.2 Maintenance Costs

The items contained in the estimates as shown will improve the radio environment of the SCMIC region. However, unless they are maintained properly these improvements will themselves degrade. Planners for the community must take into account the costs of maintaining the system. Such a capital investment certainly justifies the expense to retain its operational value. It is advisable that the Counties pursue a full service maintenance contract. CTA has estimated the costs of a maintenance contract for each level of the project. The estimate has several assumptions. This is a full service contract by a major vendor that contains:

- At least two preventative maintenance visits a year to each site
- Guaranteed on site response times to major failures
- Guaranteed repair times
- Depot service for subscriber units with spares and loaners on hand.

The estimates are reflective of the equipment added in that Term. The annual estimates are:

NEAR TERM

Gallatin County	-	$129,800.00
Madison County	-	$ 52,200.00
Meagher County	-	$ 21,200.00
Park County	-	$ 53,700.00
Sweet Grass County	-	$ 30,900.00

MID TERM

Gallatin County	-	$189,900.00
Madison County	-	$ 60,300.00
Meagher County	-	$ 32,700.00
Park County	-	$ 64,100.00
Sweet Grass County	-	$ 37,200.00

LONG TERM

Gallatin County	-	$200,400.00
Madison County	-	$ 73,500.00
Meagher County	-	$ 43,700.00
Park County	-	$ 73,000.00
Sweet Grass County	-	$ 48,200.00

FAR TERM

Gallatin County	-	$323,200.00
Madison County	-	$126,500.00
Meagher County	-	$ 72,400.00
Park County	-	$113,600.00
Sweet Grass County	-	$ 72,600.00

10.3 Lost or Non-recoverable Costs

Any project that spans a change in technology must consider if any equipment being purchased will become unusable in a further phase. The change to trunking creates such a consideration. However, the majority of the work done in this project will continue to be of value in the Far Term trunking effort. The sites and site work, antennas, cabling, generators, UPS, solar power, shelters, consoles, and etc will be used as well in a trunked system. The major issue will be the subscriber mobiles and portables which would need replacement in moving to trunked technology. However, the plan is to move to trunking and purchase trunking subscriber units after the end of the Long Term, or seven to ten years. This will place the existing subscriber units at the end of their expected lifetime. Their depreciated value at that time would be $0.00.

Certain smaller portions of the Near and Mid Term equipment will not be of use when the Long Term goal of trunking is achieved. This mainly involves the transmitter steering and receiver voting equipment. The conventional equipment that has been used in the Near and Mid Terms will not be of use in the trunking environment.

Significantly, however, the equipment will have again been in use for seven to ten years. In that regard it is appropriate to depreciate the value of the equipment. Due to the time span, we have depreciated the equipment by 70% of initial value.

The depreciated value would be:

Gallatin County	-	$23,130.00
Madison County	-	$ 1,080.00
Meagher County	-	$ 1,800.00
Park County	-	$11,205.00
Sweet Grass County	-	$ 1,080.00
Total	-	$38,295.00

10.4 Exclusive Trunking Costs

Certain costs of this project in the Far Term will be specifically for trunking technology. Portions of the radio infrastructure are designed solely to support trunking. Central control and channel selection equipment is designed for trunking specific applications.

The major area of change will be in the subscriber equipment. That equipment will require trunking software in order to operate and therefore has a higher cost. Typically this trunking software costs between $400.00 and $750.00 per unit. In reality it is not so simple as to add trunking software to a radio and convert it to trunking; not every radio is capable of accepting the trunking software.

The identified costs for trunking are shown in the Far Term estimates.

10.5 Project Management Independent Verification and Validation

Upgrading communications in five counties is a significant undertaking. In order to achieve the improvements recommended for the various SCMIC counties CTA anticipates the purchasing process will be quite involved. The equipment and services needed fall into five major categories:

Fixed - This includes transmitters, receivers, repeaters, antennas, multicouplers and combiners, voters, and simulcast equipment.

Sites or Physical Facilities - This category is perhaps the most difficult to identify. Contained here are towers, foundations, geotechnical surveys, tower analysis, site clearing, access road paving, security fencing, lighting, shelters, generators, UPS power supplies, HVAC, solar power, utilities connections, and grounding.

Microwave - This includes both *licensed* and *licensed - spread spectrum* (4.9) microwave radios, microwave antennas, wave guide and other cabling, orderwire, Loop and Hot Standby switches, and DC power supplies.

Non-Fixed - This includes the mobile and portable radio equipment that will be used. Desk-top radios and pagers are in this category.

Consoles - Equip the dispatch centers for communications and include dispatcher terminals as well as back-room equipment.

Mobile Data – This includes the field units with RF modems and laptops and/or terminals, the RF data portion also includes data transmitters and receivers with antennas and cabling, as well as data radio network control devices.

Purchasing two way radio systems is a complex and detailed process. Each County may be inclined to turn to single vendors to provide a "turn-key" solution. While at first glance this may seem to be efficient, we note that the requirement of “turn key” service may not be the most efficient use of your capital. Since this is a *Radio system*, one would expect that *Radio equipment vendors* would normally be the ones you would approach for this service.

The inefficiency in the methodology is that radio equipment providers do not internally provide the ancillaries: microwave and particularly physical facilities as part of their product line. Radio vendors' core business is to sell fixed and non-fixed radio equipment. Typically radio vendors have outsourced those efforts not part of their core business, and they do so mainly to assist their clients while selling their radio equipment.

As would be expected, in the outsourcing, the price for the service is escalated with pass through fees and administrative add-ons, as well as risk factors for unanticipated events. Potentially there is little financial incentive for the turn-key vendor to optimize these activities for a specific project. Non-radio expenses could as much as double when acquired from a turn-key vendor.

With respect to purchase of Mobile Data systems, the Radio System Vendors do frequently provide this product. There are a substantial number of equipment vendors that focus on Mobile Data as their primary product and the following issues should be considered:

- A vendor that is focused on Mobile Data may bring state-of-the-art innovation to this rapidly changing technology;
- Competition will drive the price down;
- The Mobile Radio vendors will not be excluded, they may take part in the process as well, and if there are any efficiencies involved in a common voice and data network, this will be to their favor.

To reduce costs, CTA recommends that the SCMIC pursue a regional five part purchase process. This would involve five separate purchase/specification/bidding efforts:

1. Fixed Radio Equipment to include consoles.
2. Physical Facilities
3. Microwave
4. Non-Fixed Equipment
5. Mobile Data

This will produce a common pool of equipment and service pricing that each county can select from and will give the SCMIC Counties the most effective pricing.

The selected vendor or vendors in each category should be vendors that are specialists in that category and well versed in providing the specific services and/or equipment. This five step procurement process will provide vendors that are more directed and expert in their particular area. This will give the SCMIC Consortium the best possible financial and product results.

In the cost estimate, there is a category for PM/IV&V. This accounts for the services of experienced project managers and communications experts to conduct and oversee these added purchasing procedures with inspections and independent testing and verification after installations.

The separate procurements should be planned around a phased approach, with long term costs escalation controls. Typically the costs are only allowed to escalate in accordance with the Manufacturers' Cost Index which is published nationally.

10.6 Gallatin County Estimate of Probable Cost

Cost estimates for Gallatin County were developed for the major categories of equipment as described in the design sections above for the County.

The PM/IV&V costs are our estimates of the expenses for professional engineering, design, project management, and independent verification of performance for these elements of your requirements.

The unit cost information is obtained from historical CTA cost files and vendor pricing for comparable projects. The various costs are compared and weighted in order to derive an average type of estimate.

Estimates reflect expected average pricing. The average prices are recommended for planning and budgetary purposes. Although CTA cannot guarantee bid price levels, successful competitive bidding typically results in substantial savings, especially in the area of radio equipment.

There are four charts displaying the estimates included here. These are for Near Term, Mid Term, Long Term, and Far Term phases, and contain within each phase consolidated costs for the entire recommended improvements for the County.

CHART 10-6A Gallatin County Near Term Estimate

CHART 10-6B Gallatin County Mid Term Estimate

CHART 10-6C Gallatin County Long Term Estimate

CHART 10-6D Gallatin County Far Term Estimate

10.7 Madison County Estimate of Probable Cost

Cost estimates for Madison County were developed for the major categories of equipment as described in the design sections above for the County.

There are four charts displaying the estimates included here. These are for Near Term, Mid Term, and Long Term phases, and contain within each phase consolidated costs for the entire recommended improvements for the County.

CHART 10-7A Madison County Near Term Estimate

CHART 10-7B Madison County Mid Term Estimate

CHART 10-7C Madison County Long Term Estimate

CHART 10-7D Madison County Far Term Estimate

10.8 Meagher County Estimate of Probable Cost

Cost estimates for Meagher County were developed for the major categories of equipment as described in the design sections above for the County.

There are four charts displaying the cost estimates included here. These are for Near Term, Mid Term, Long Term, and Far Term phases, and contain within each phase consolidated costs for the entire recommended improvements for the County.

CHART 10-8A Meagher County Near Term Estimate

CHART 10-8B Meagher County Mid Term Estimate

CHART 10-8C Meagher County Long Term Estimate

CHART 10-8D Meagher County Far Term Estimate

10.9 Park County Estimate of Probable Cost

Cost estimates for Park County were developed for the major categories of equipment as described in the design sections above for the County.

There are four charts displaying the cost estimates included here. These are for Near Term, Mid Term, Long Term, and Far Term phases, and contain within each phase consolidated costs for the entire recommended improvements for the County.

CHART 10-9A Park County Near Term Estimate

CHART 10-9B Park County Mid Term Estimate

CHART 10-9C Park County Long Term Estimate

CHART 10-9D Park County Far Term Estimate

10.10 Sweet Grass County Estimate of Probable Cost

Cost estimates for Sweet Grass County were developed for the major categories of equipment as described in the design sections above for the County.

There are four charts displaying the cost estimates included here. These are for Near Term, Mid Term, Long Term, and Far Term phases, and contain within each phase consolidated costs for the entire recommended improvements for the County.

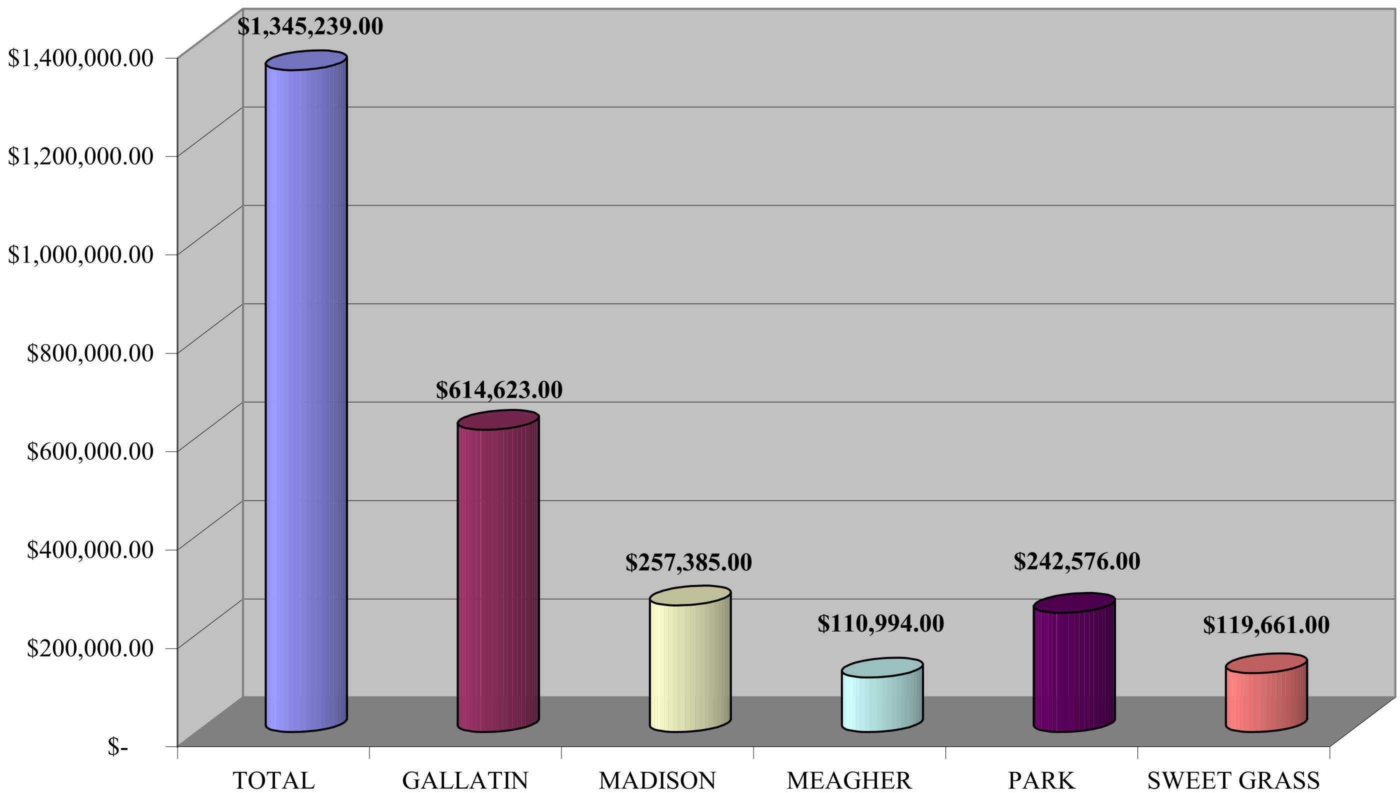
CHART 10-10A Sweet Grass County Near Term Estimate

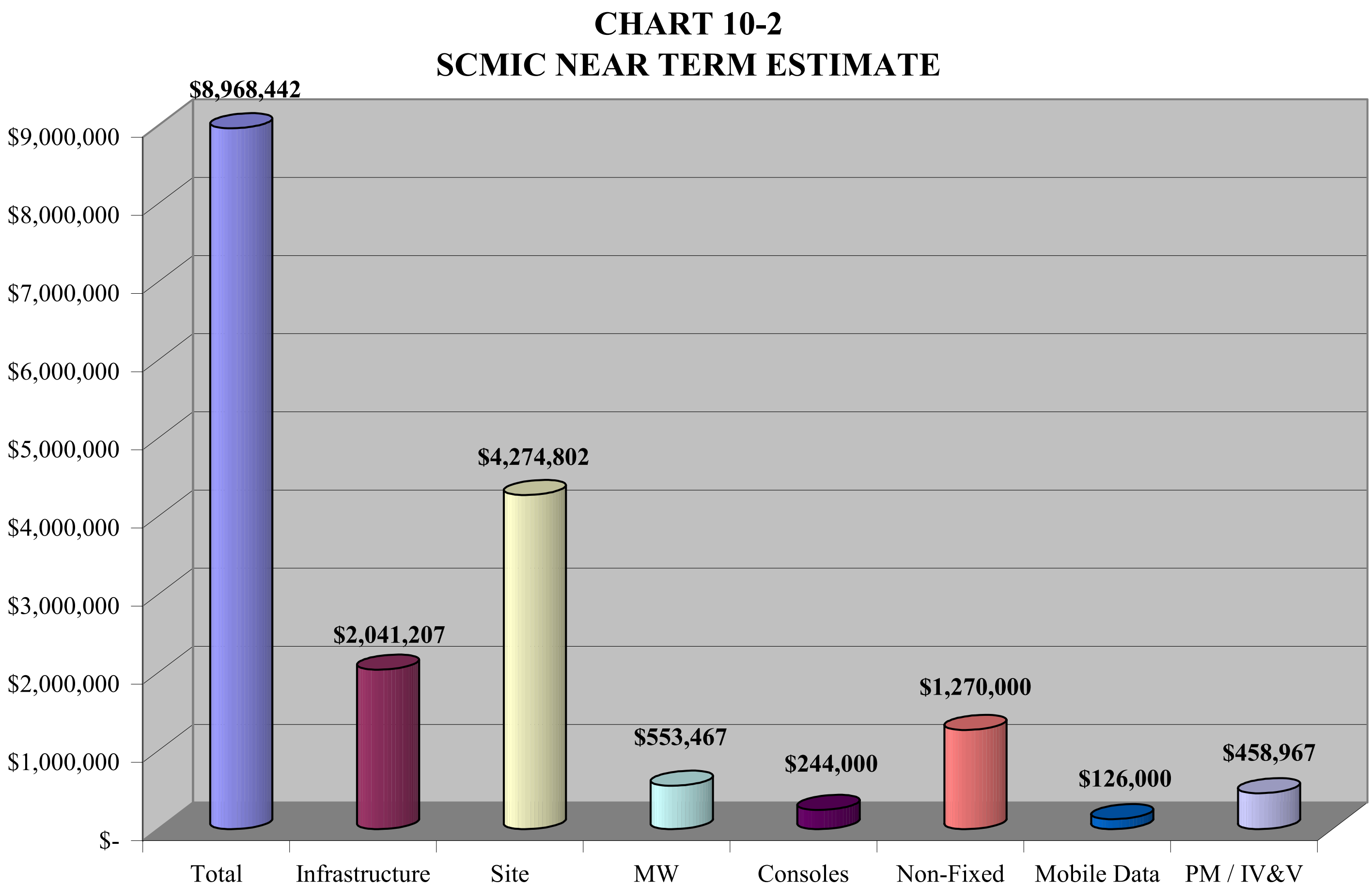
CHART 10-10B Sweet Grass County Mid Term Estimate

CHART 10-10C Sweet Grass County Long Term Estimate

CHART 10-10D Sweet Grass County Far Term Estimate

CHART 10-1
SCMIC IMMEDIATE ESTIMATE

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SCMIC NEAR TERM ESTIMATE
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$8,000,000
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$-
$8,968,442
$2,041,207
$4,274,802
$553,467
$244,000
$1,270,000
$126,000
$458,967
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

CHART 10 - 3
SCMIC MID TERM ESTIMATE

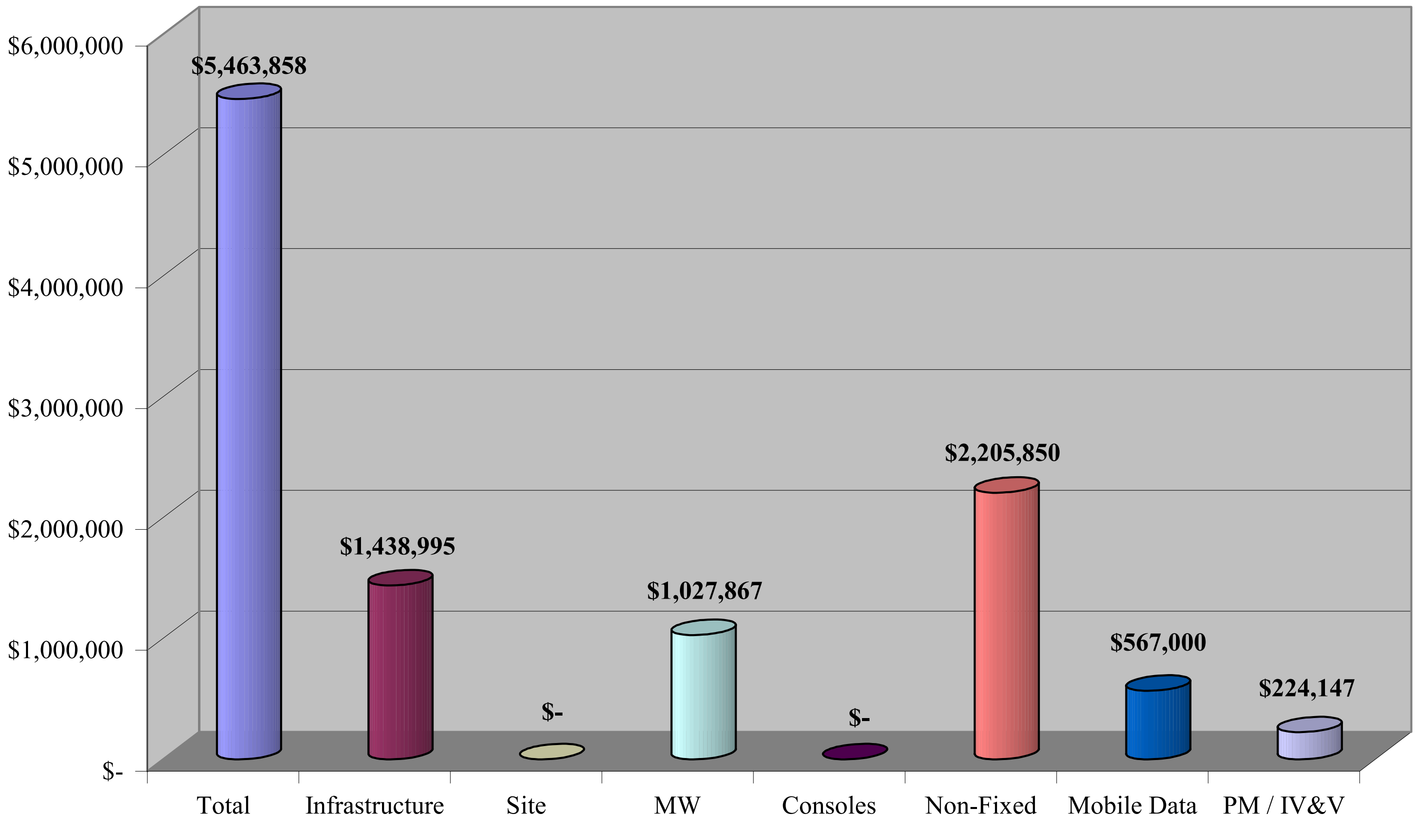


CHART 10 - 4
SCMIC LONG TERM ESTIMATE

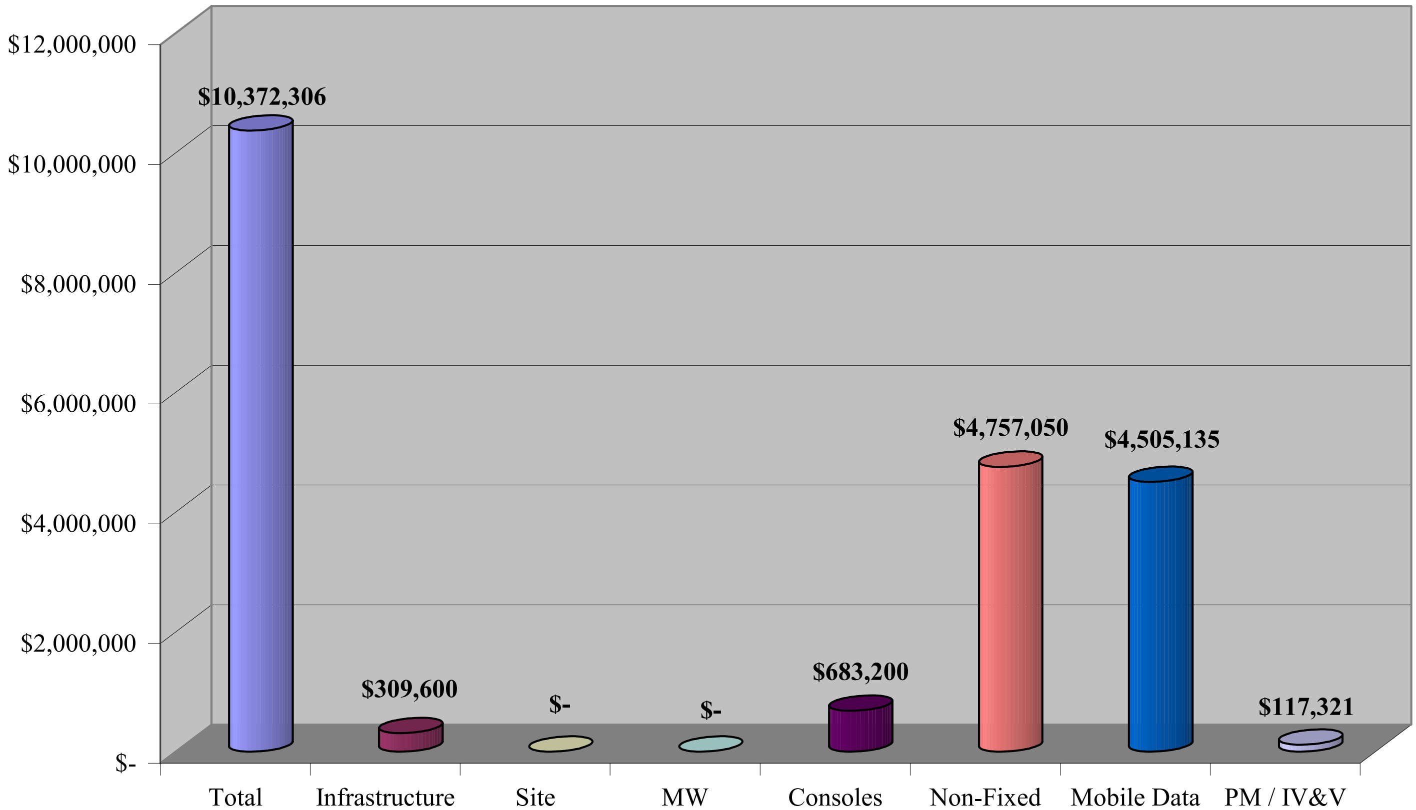
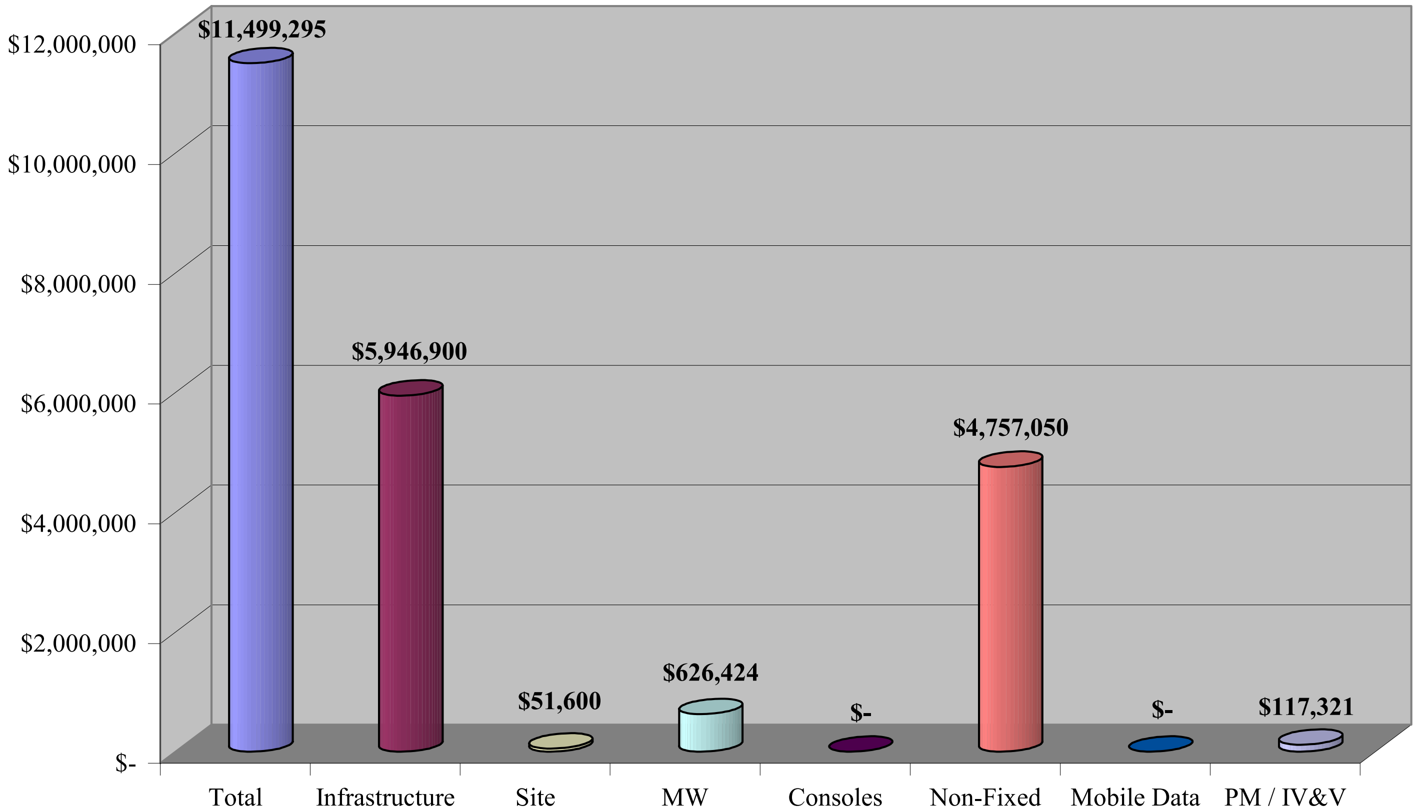


CHART 10 - 5
SCMIC FAR TERM ESTIMATE



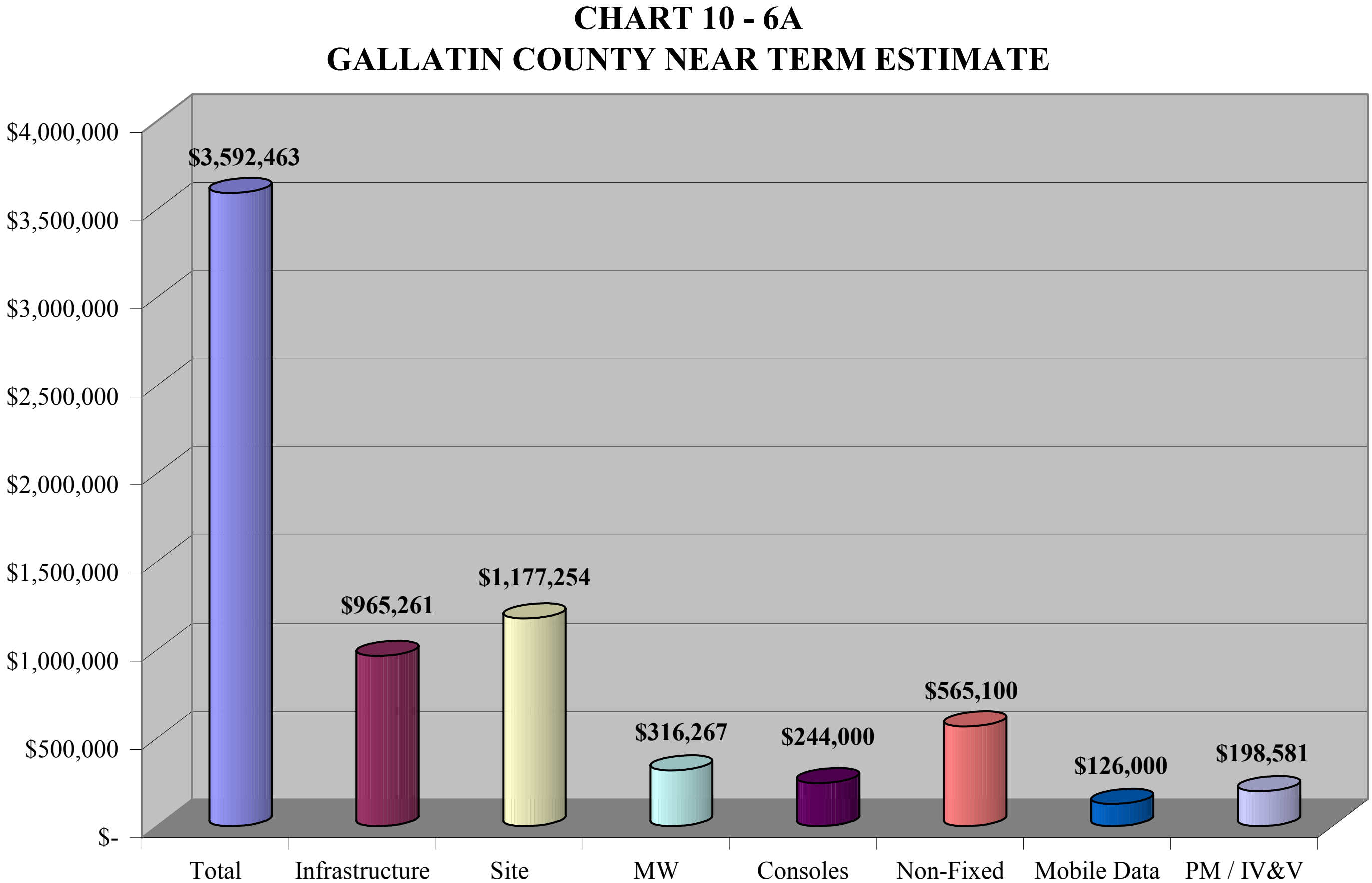


CHART 10 - 6A
GALLATIN COUNTY NEAR TERM ESTIMATE
$4,000,000
$3,500,000
$3,000,000
$2,500,000
$2,000,000
$1,500,000
$1,000,000
$500,000
$-
$3,592,463
$965,261
$1,177,254
$316,267
$244,000
$565,100
$126,000
$198,581
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

CHART 10 - 6B
GALLATIN COUNTY MID TERM ESTIMATE

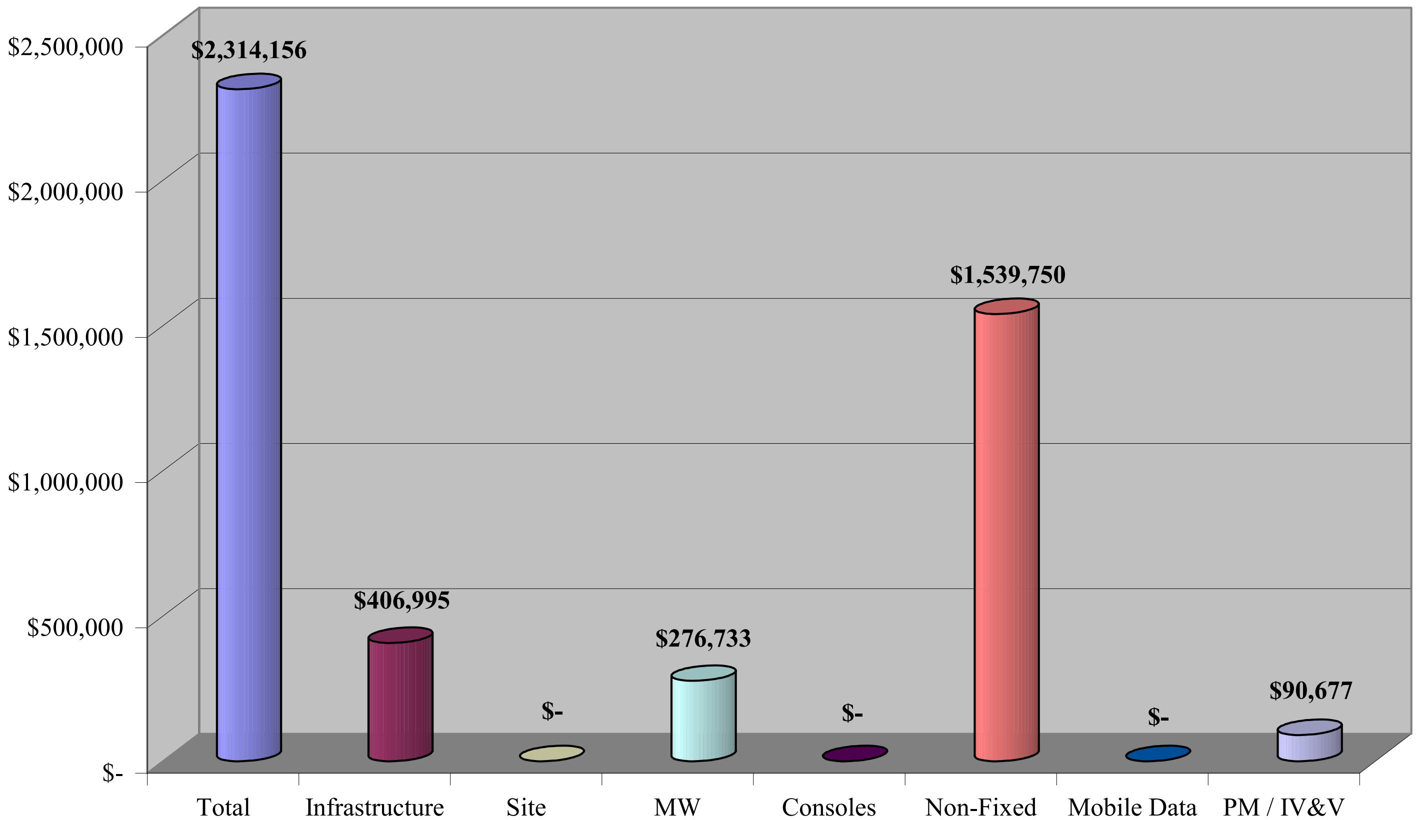
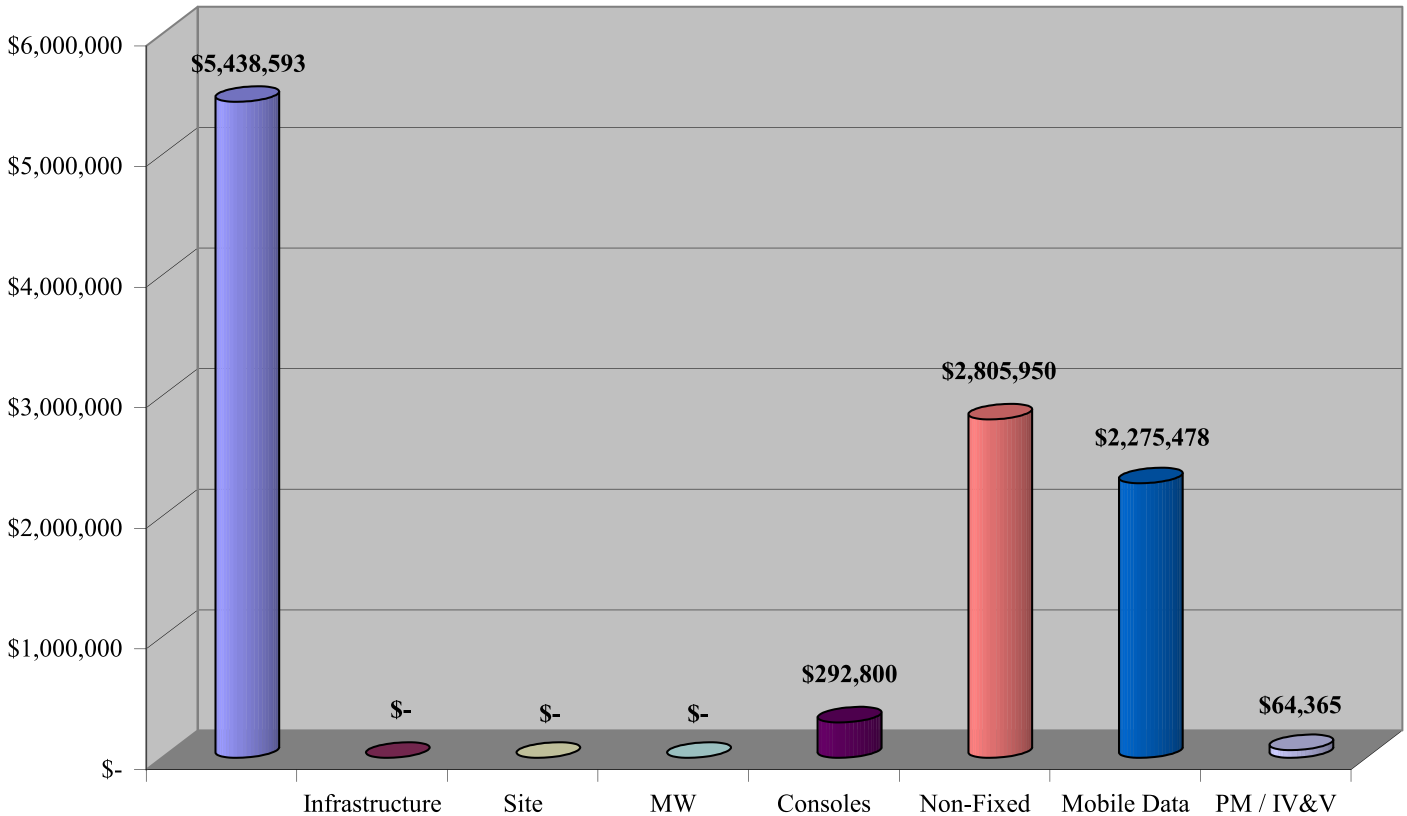


CHART 10 - 6C
GALLATIN COUNTY LONG TERM ESTIMATE



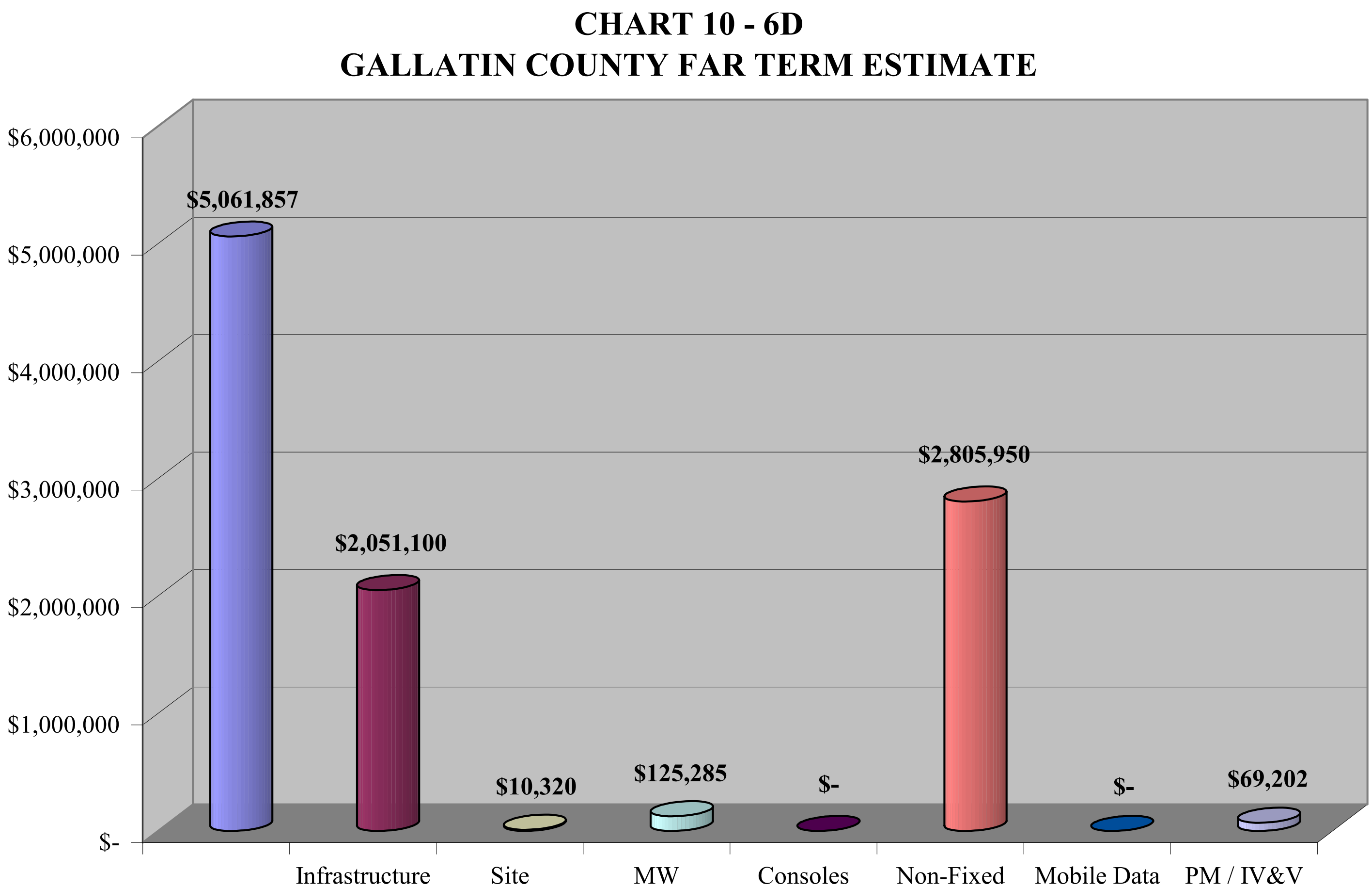


CHART 10 - 6D
GALLATIN COUNTY FAR TERM ESTIMATE
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$-
$5,061,857
$2,051,100
$10,320
$125,285
$-
$2,805,950
$-
$69,202
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

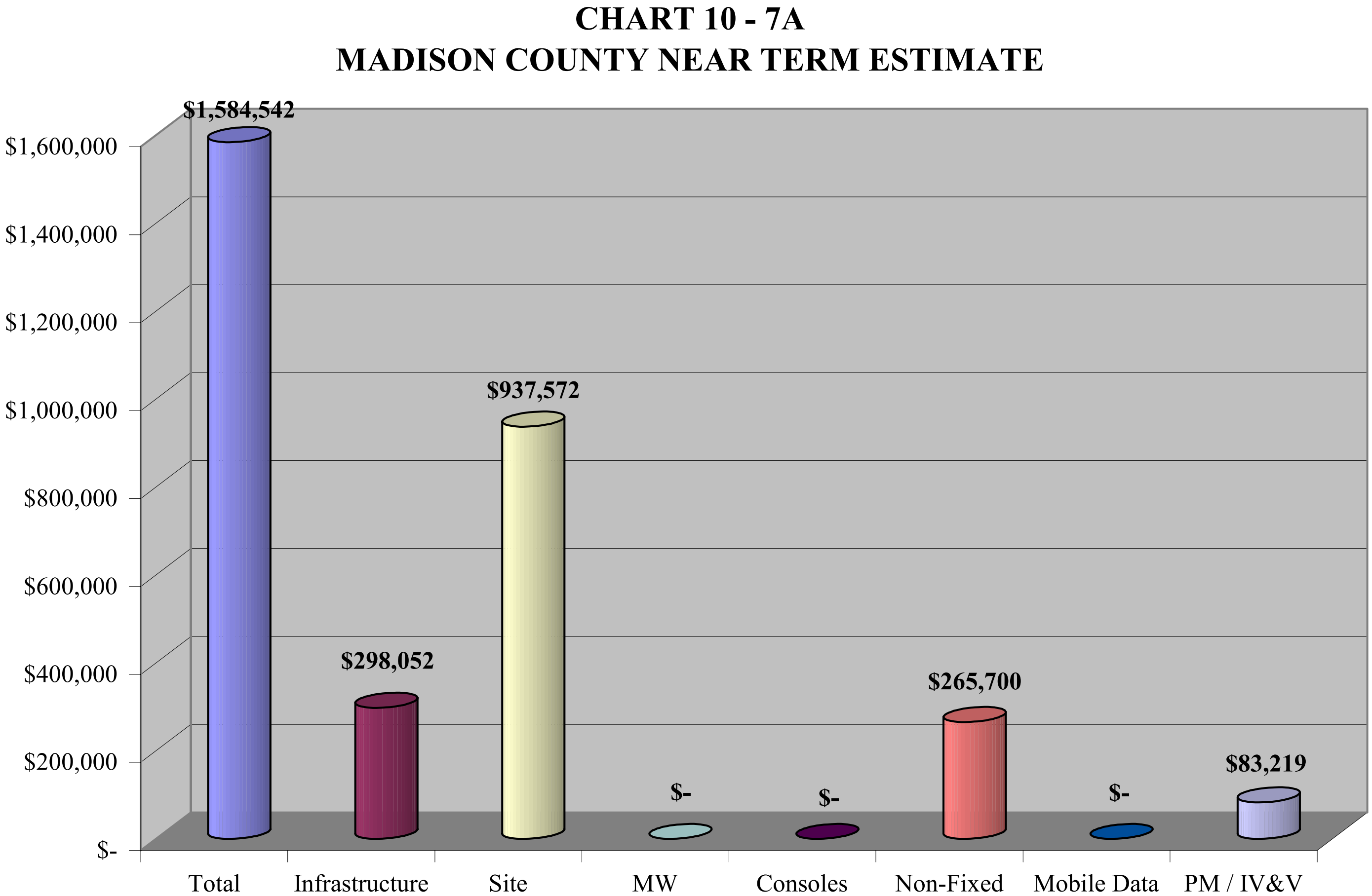


CHART 10 - 7A
MADISON COUNTY NEAR TERM ESTIMATE
$1,584,542
$298,052
$937,572
$-
$-
$265,700
$-
$83,219
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$-
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

CHART 10 - 7B
MADISON COUNTY MID TERM ESTIMATE

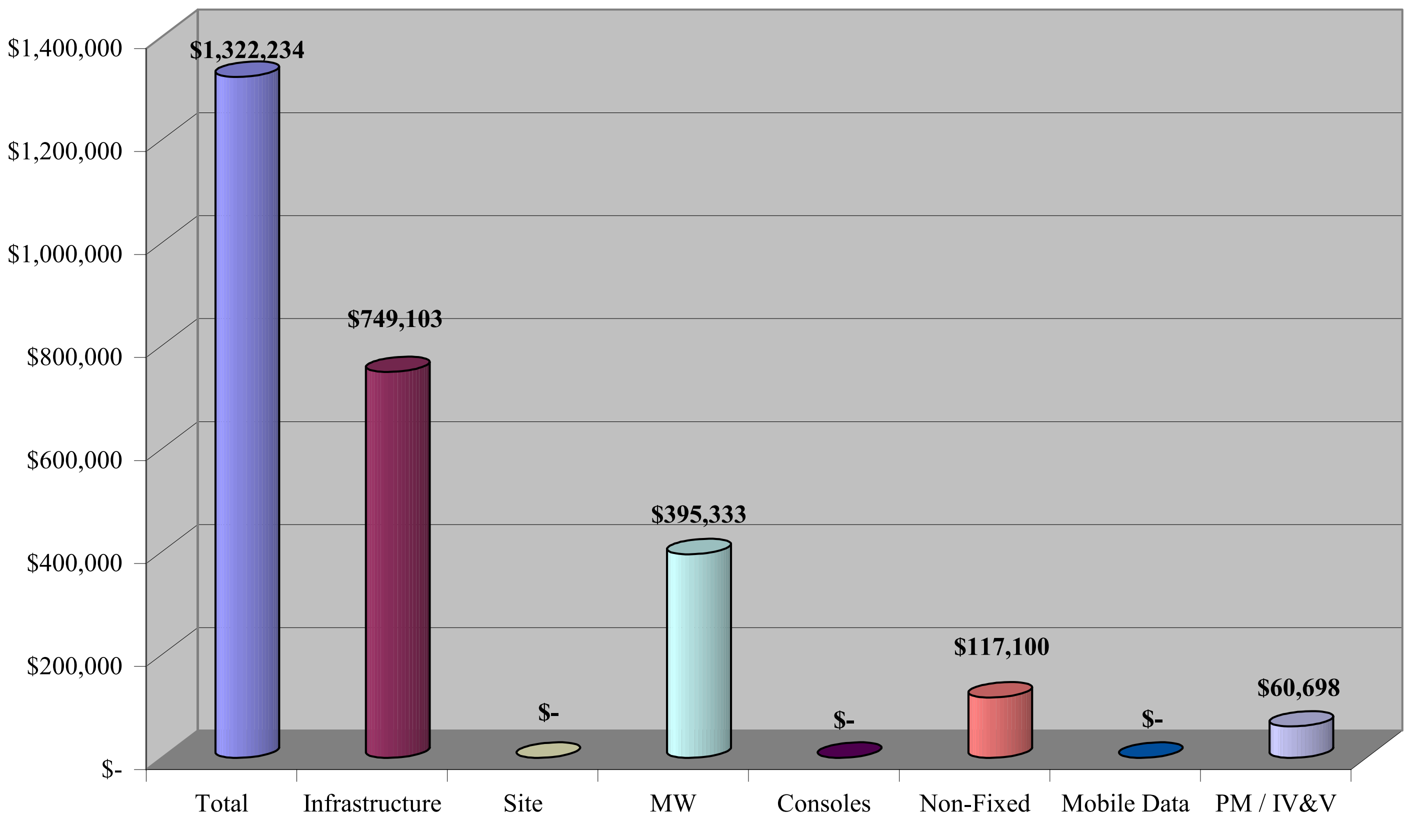
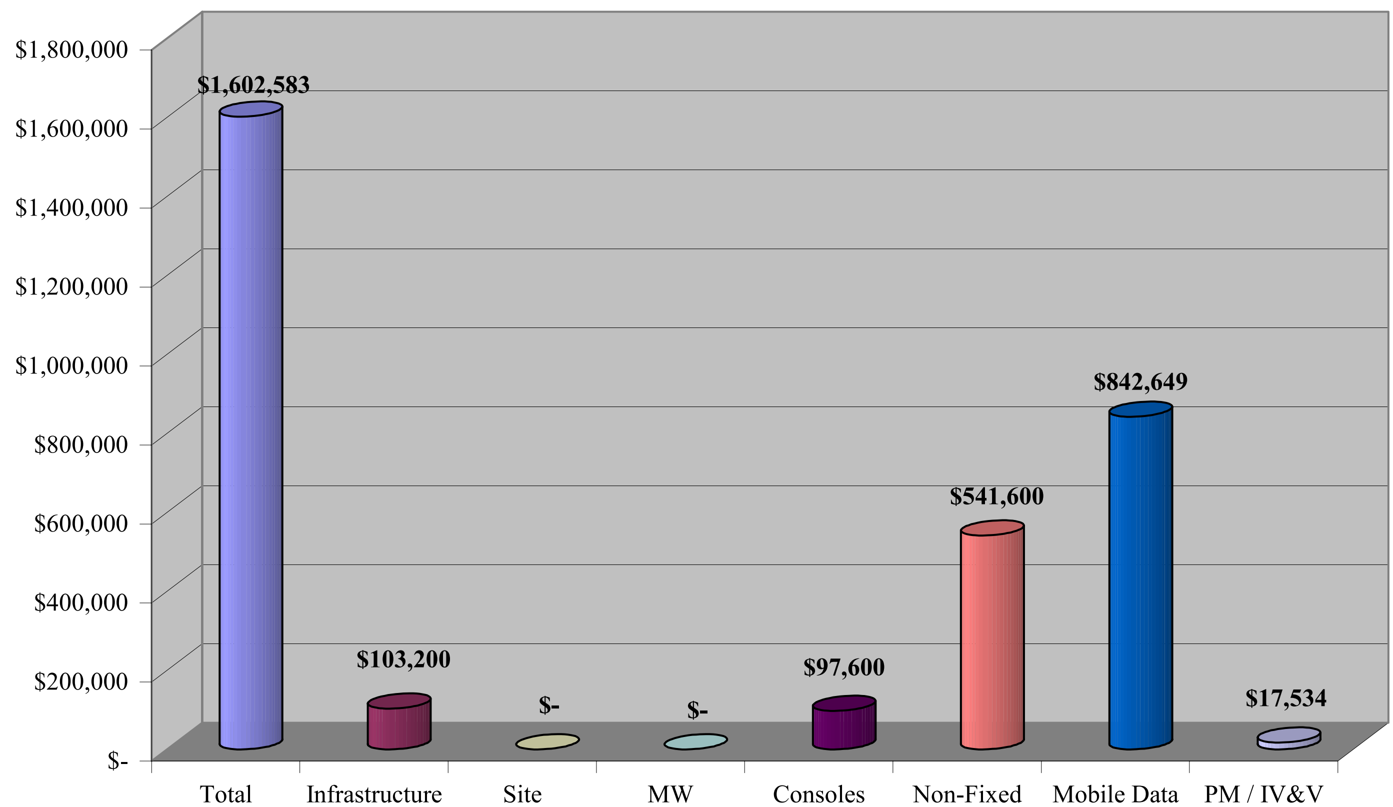


CHART 10 - 7C
MADISON COUNTY LONG TERM ESTIMATE



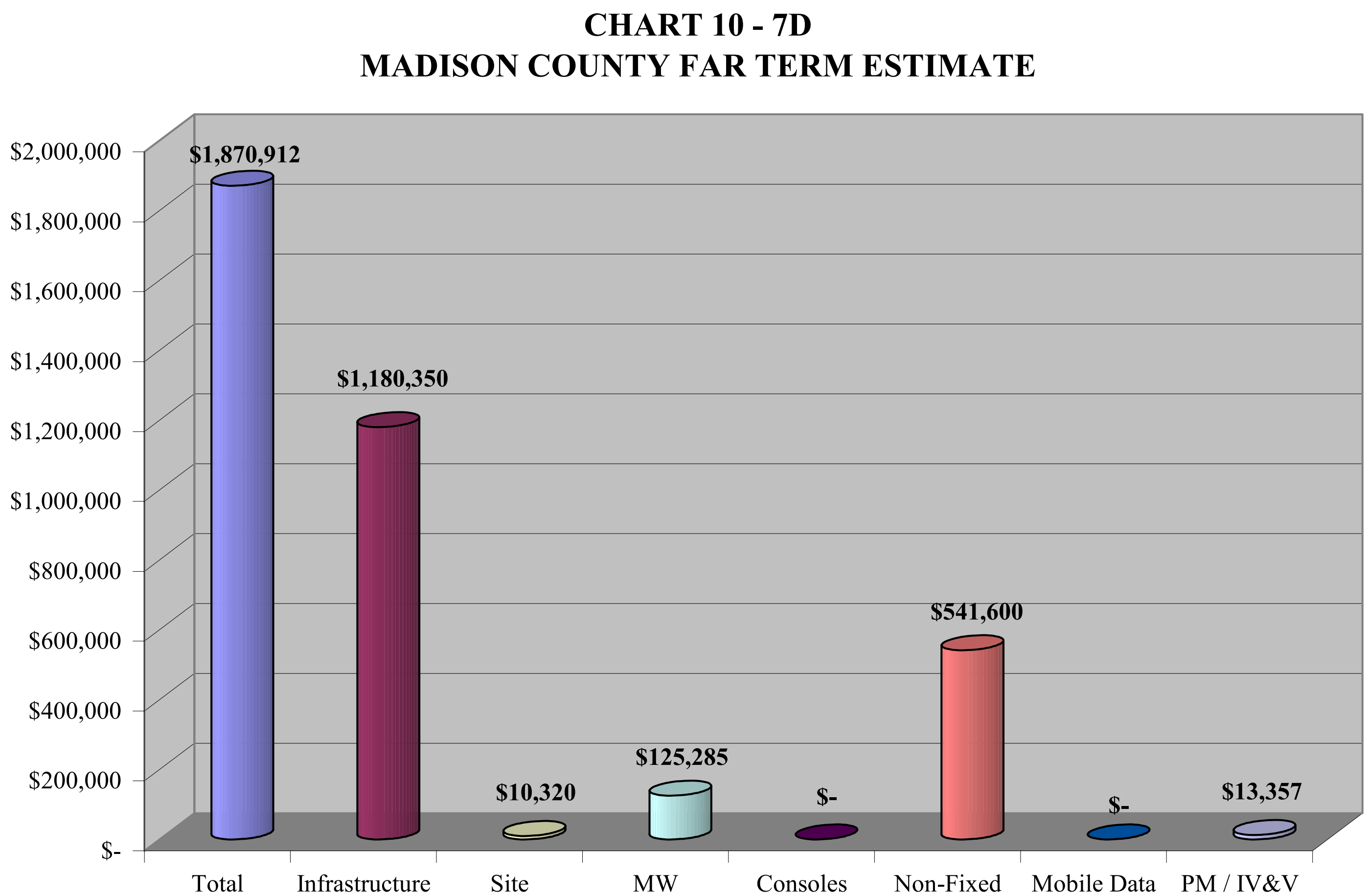
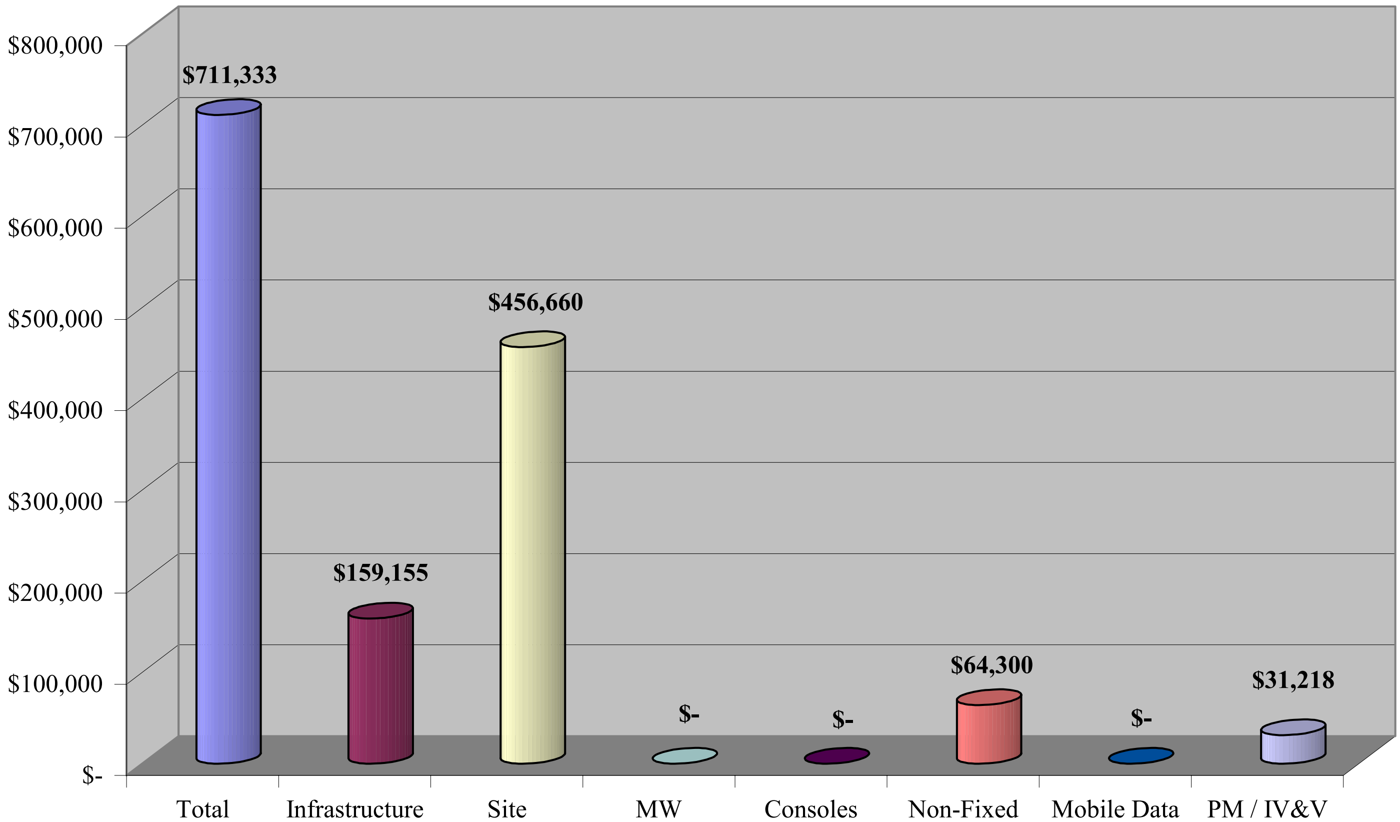


CHART 10 - 7D
MADISON COUNTY FAR TERM ESTIMATE
$2,000,000
$1,800,000
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$-
$1,870,912
$1,180,350
$10,320
$125,285
$-
$541,600
$-
$13,357
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

CHART 10-8A
MEAGHER COUNTY NEAR TERM ESTIMATE



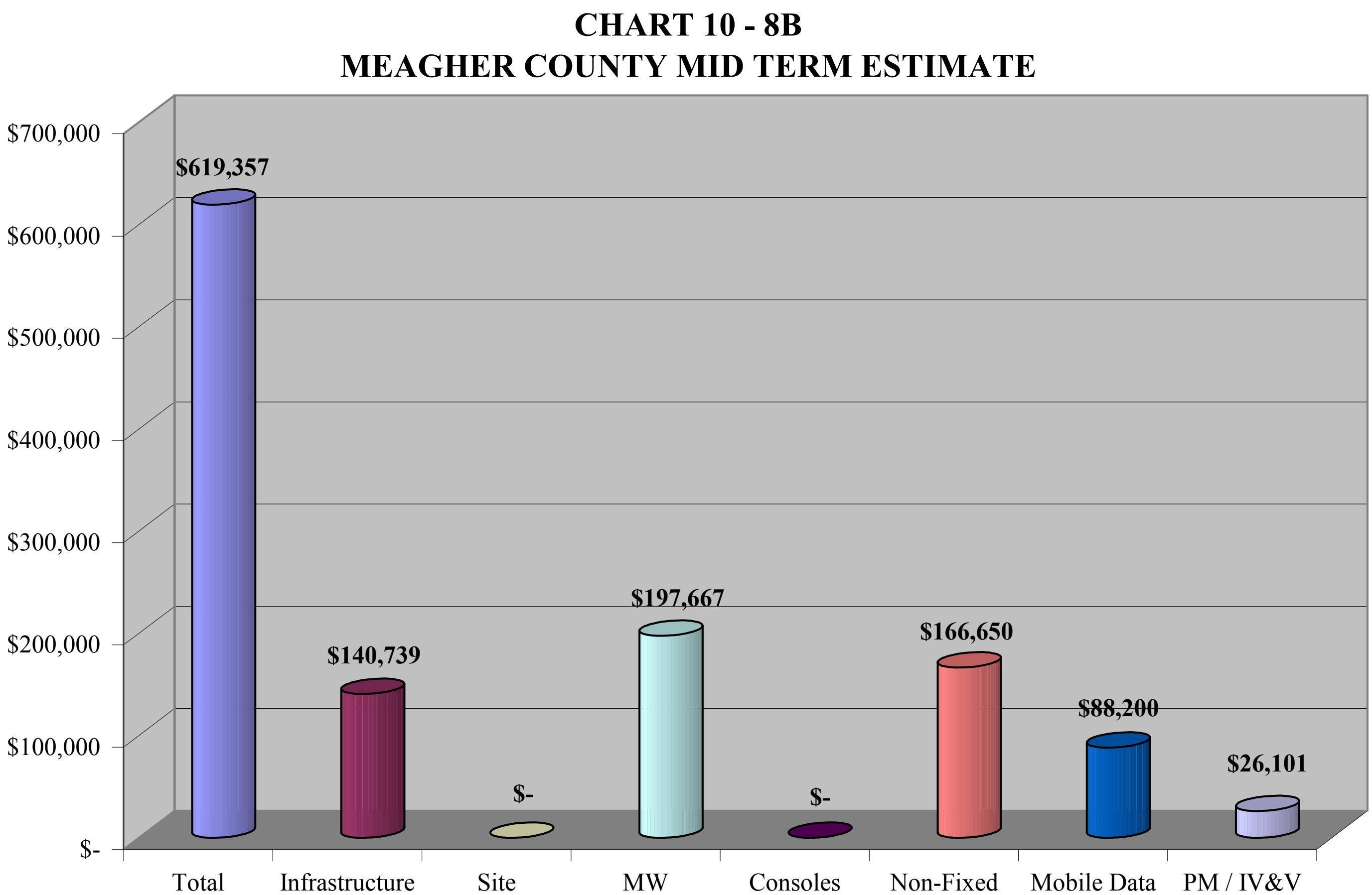


CHART 10 - 8B
MEAGHER COUNTY MID TERM ESTIMATE
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$-
$619,357
$140,739
$-
$197,667
$-
$166,650
$88,200
$26,101
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

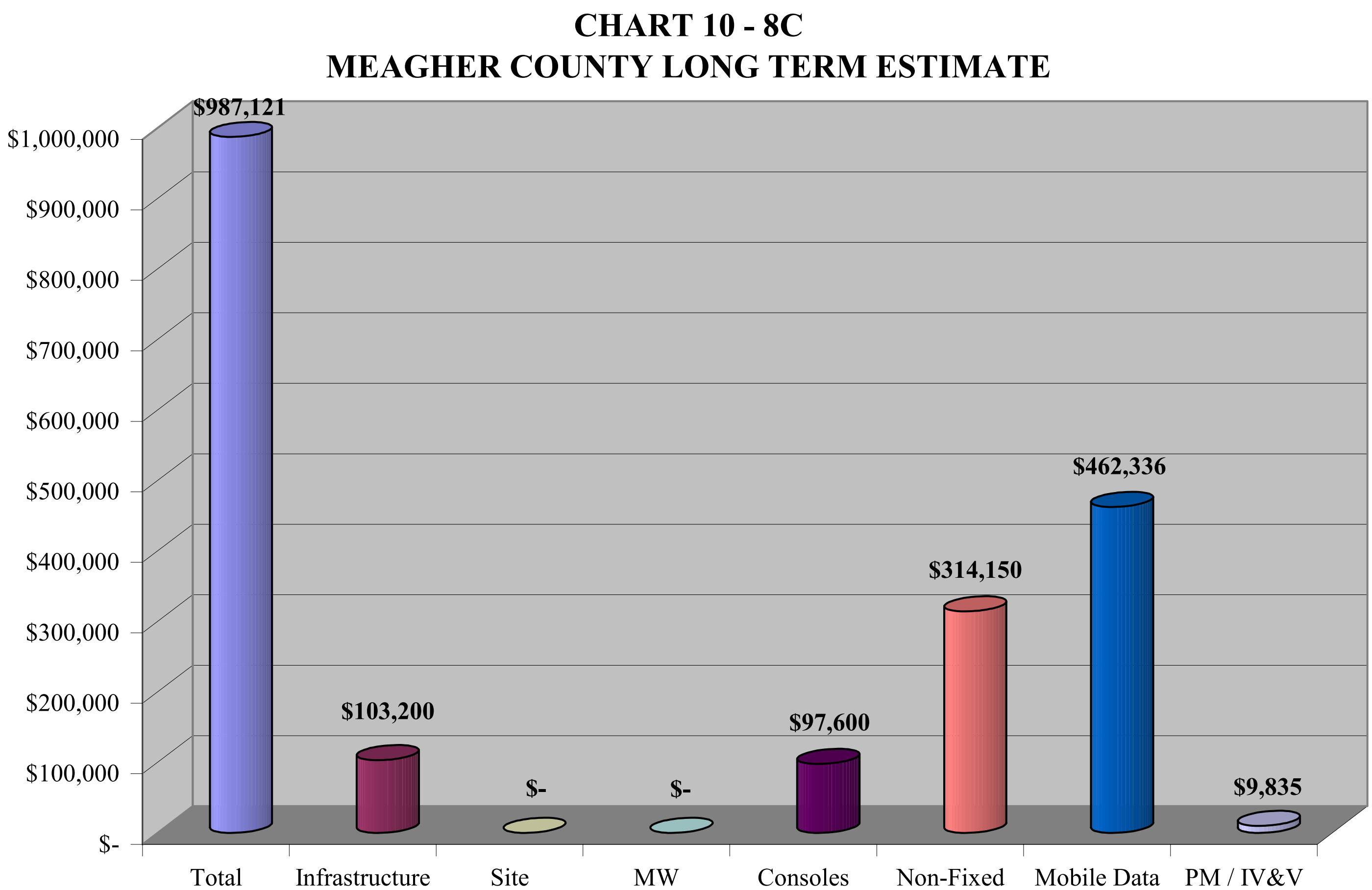
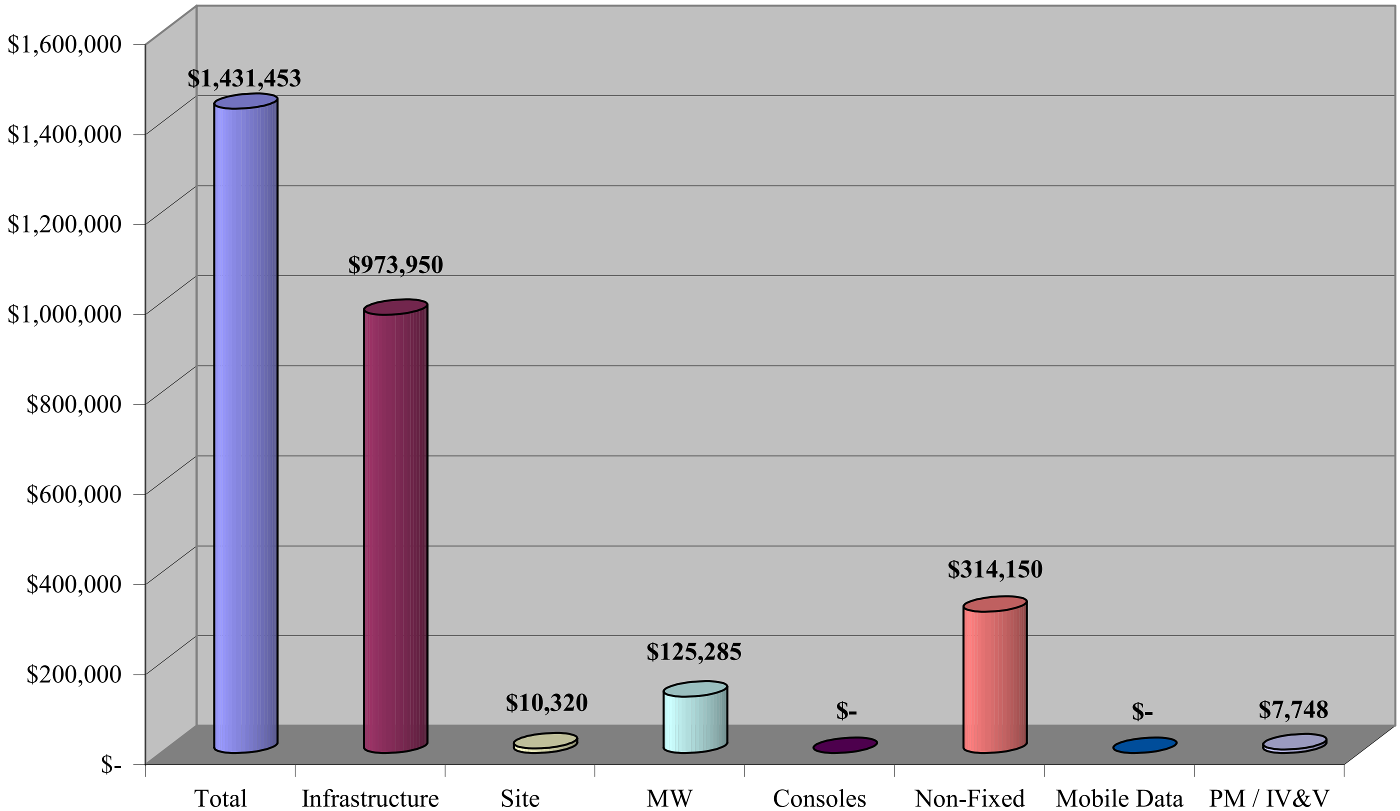


CHART 10 - 8C
MEAGHER COUNTY LONG TERM ESTIMATE
$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$-
$987,121
$103,200
$-
$-
$97,600
$314,150
$462,336
$9,835
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

CHART 10 - 8D
MEAGHER COUNTY FAR TERM ESTIMATE



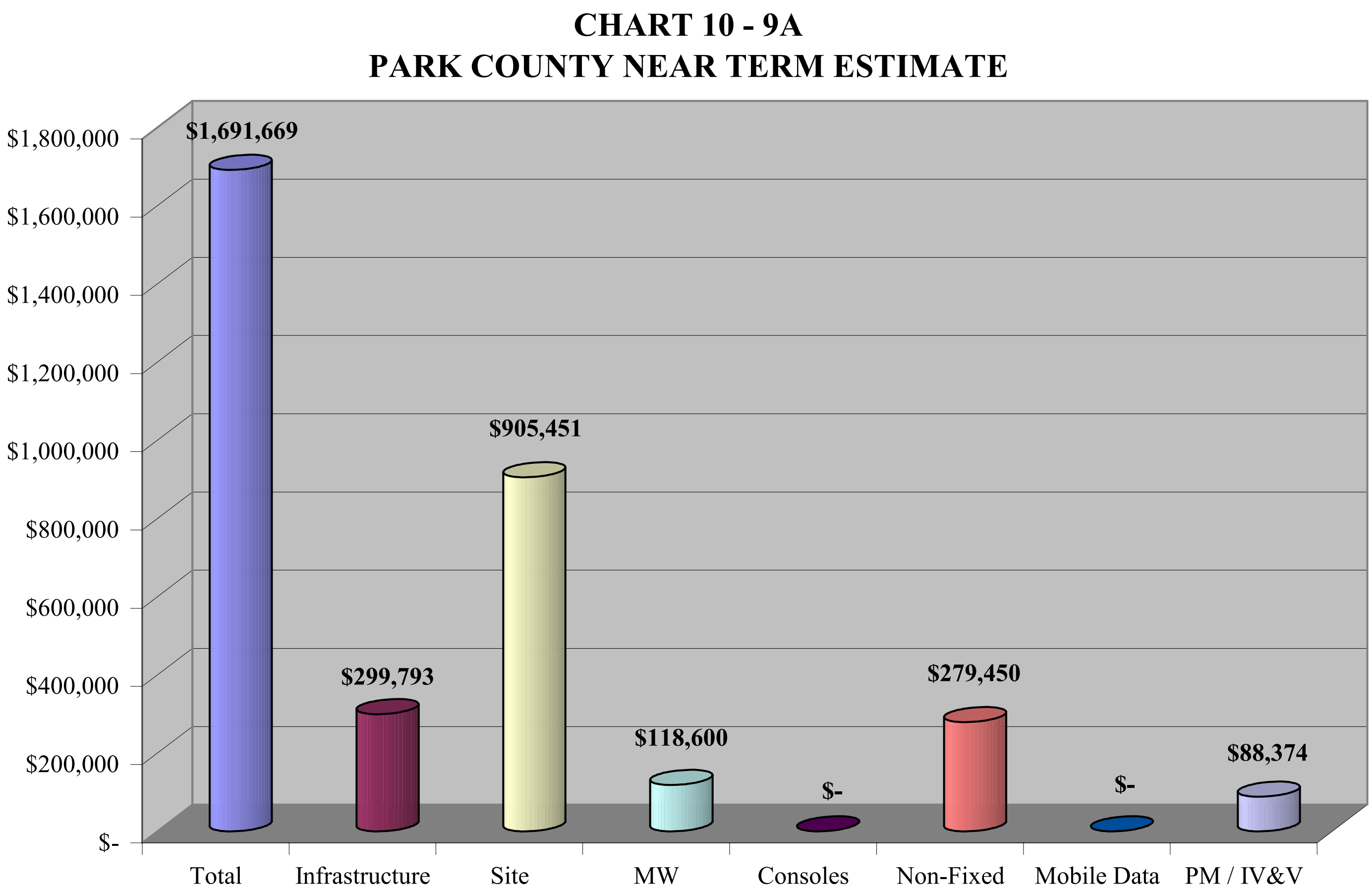


CHART 10 - 9A
PARK COUNTY NEAR TERM ESTIMATE
$1,800,000
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$-
$1,691,669
$299,793
$905,451
$118,600
$-
$279,450
$-
$88,374
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

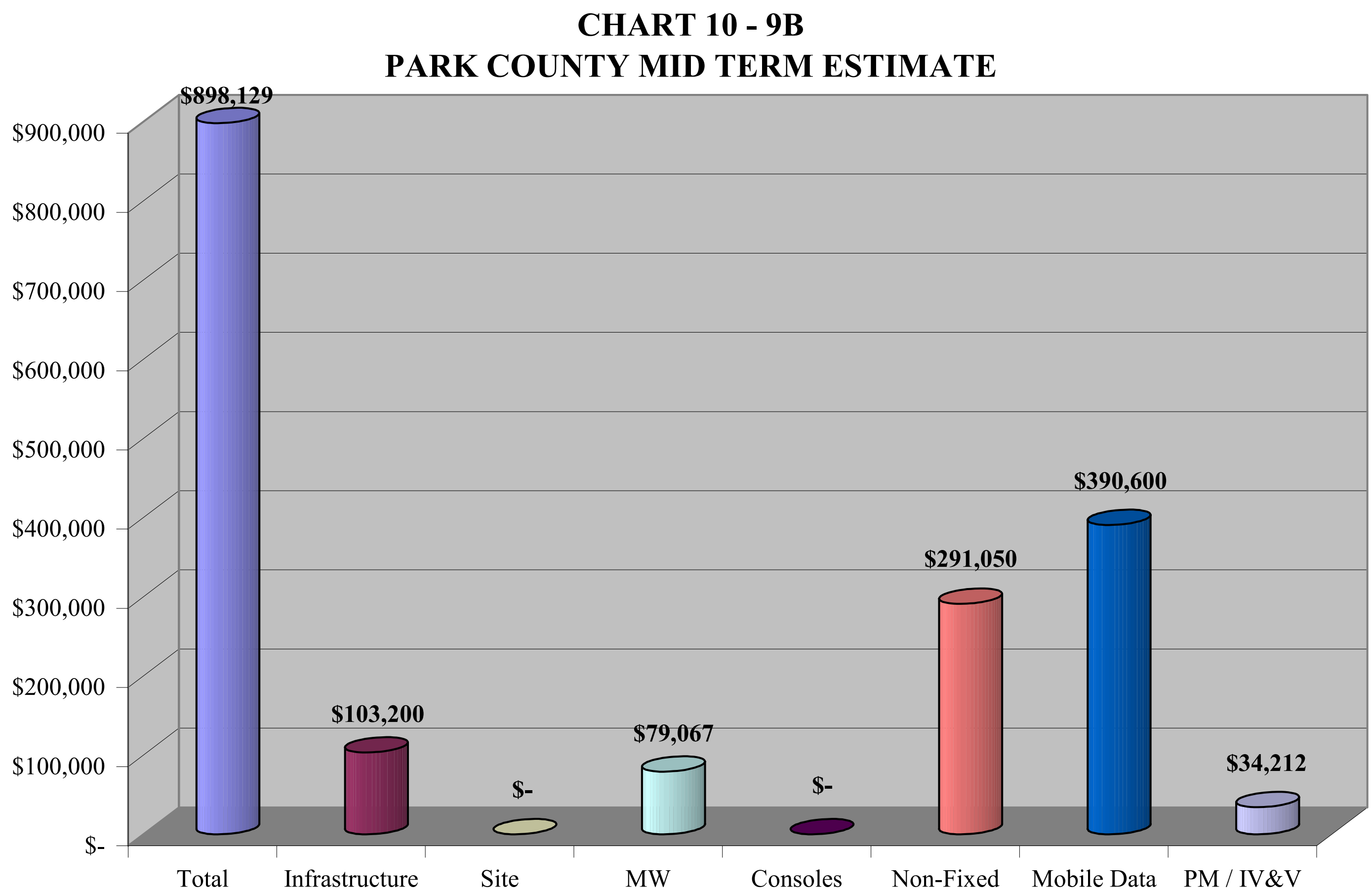


CHART 10 - 9B
PARK COUNTY MID TERM ESTIMATE
$898,129
$103,200
$-
$79,067
$-
$291,050
$390,600
$34,212
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$-
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

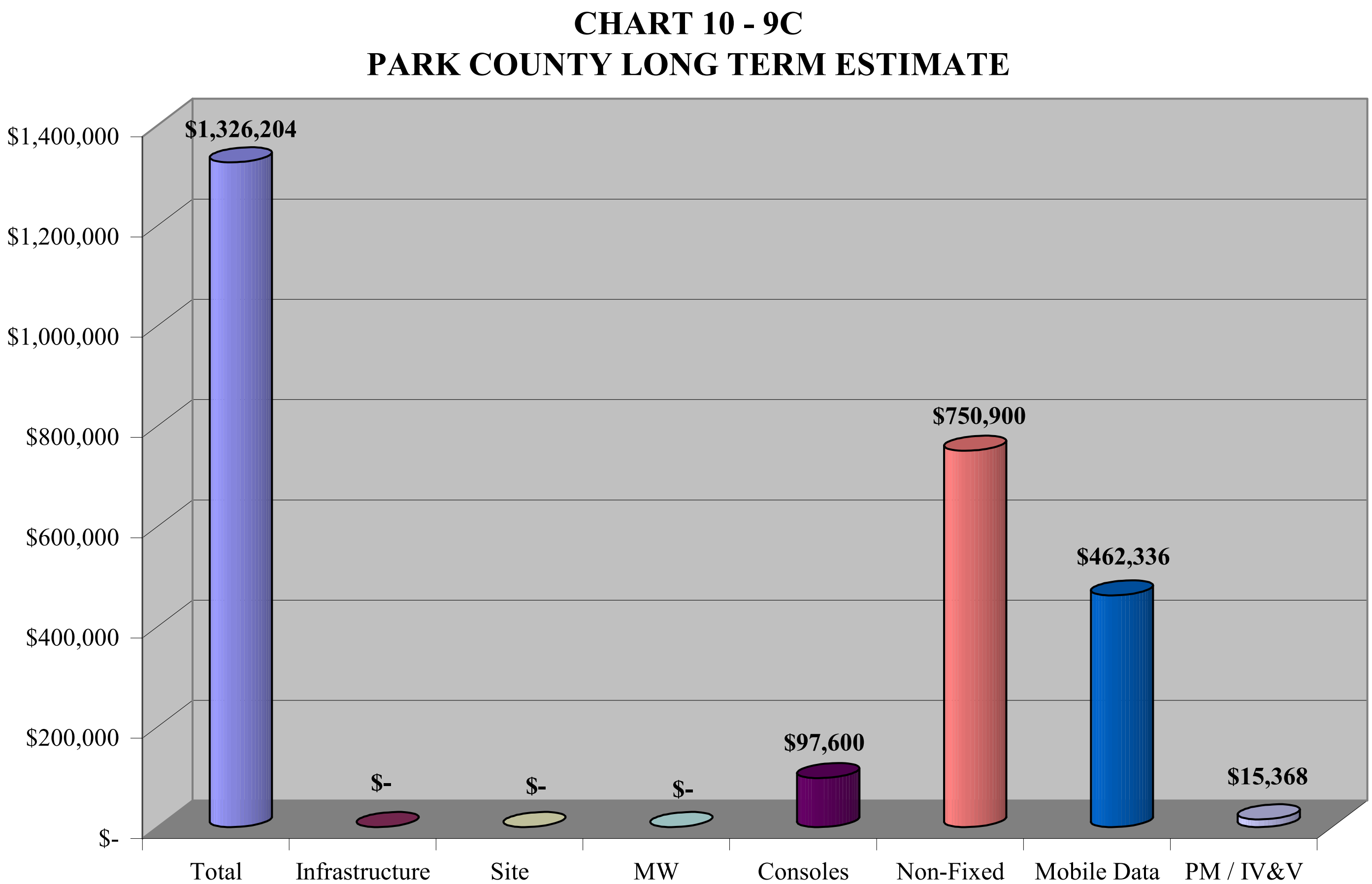


CHART 10 - 9C
PARK COUNTY LONG TERM ESTIMATE
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$-
$1,326,204
$-
$-
$-
$97,600
$750,900
$462,336
$15,368
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

CHART 10 - 9D
PARK COUNTY FAR TERM ESTIMATE

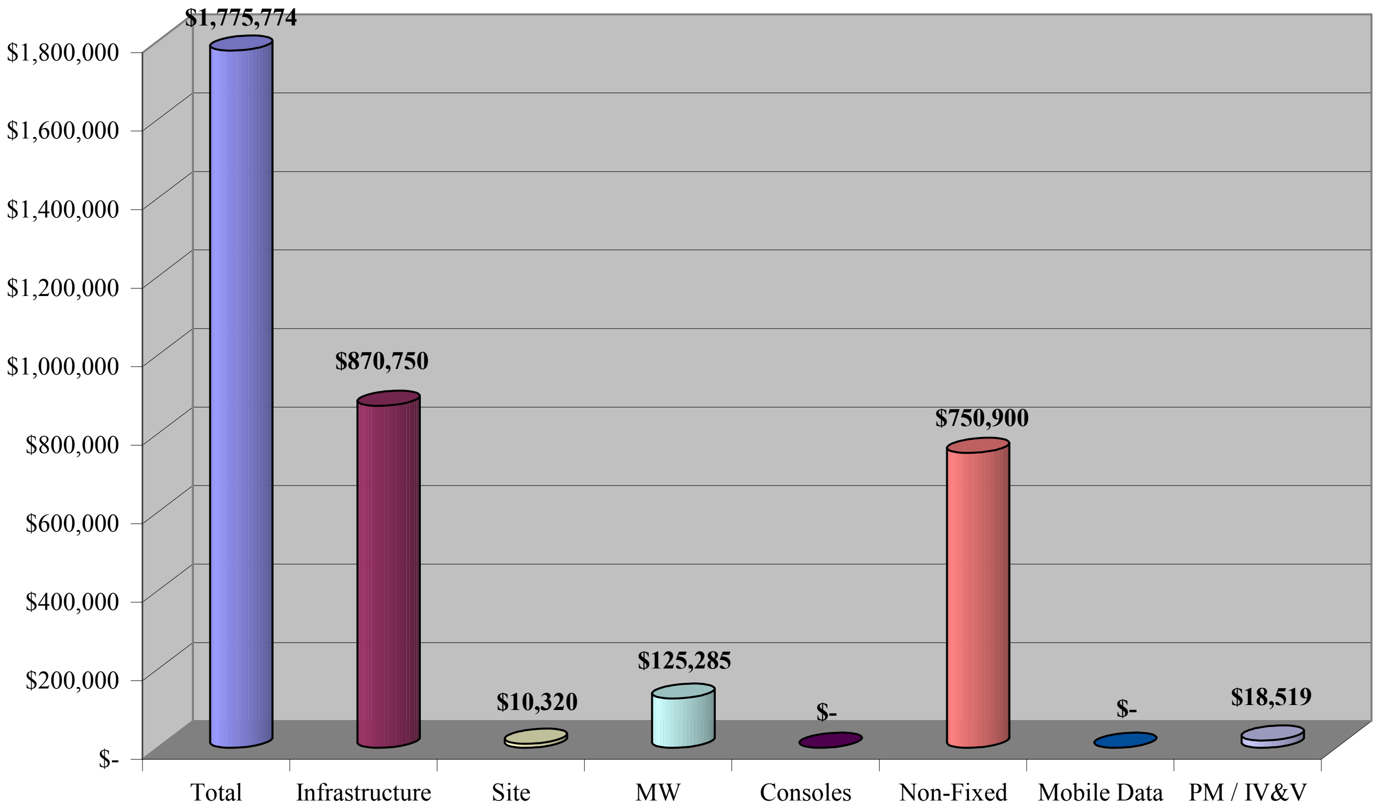
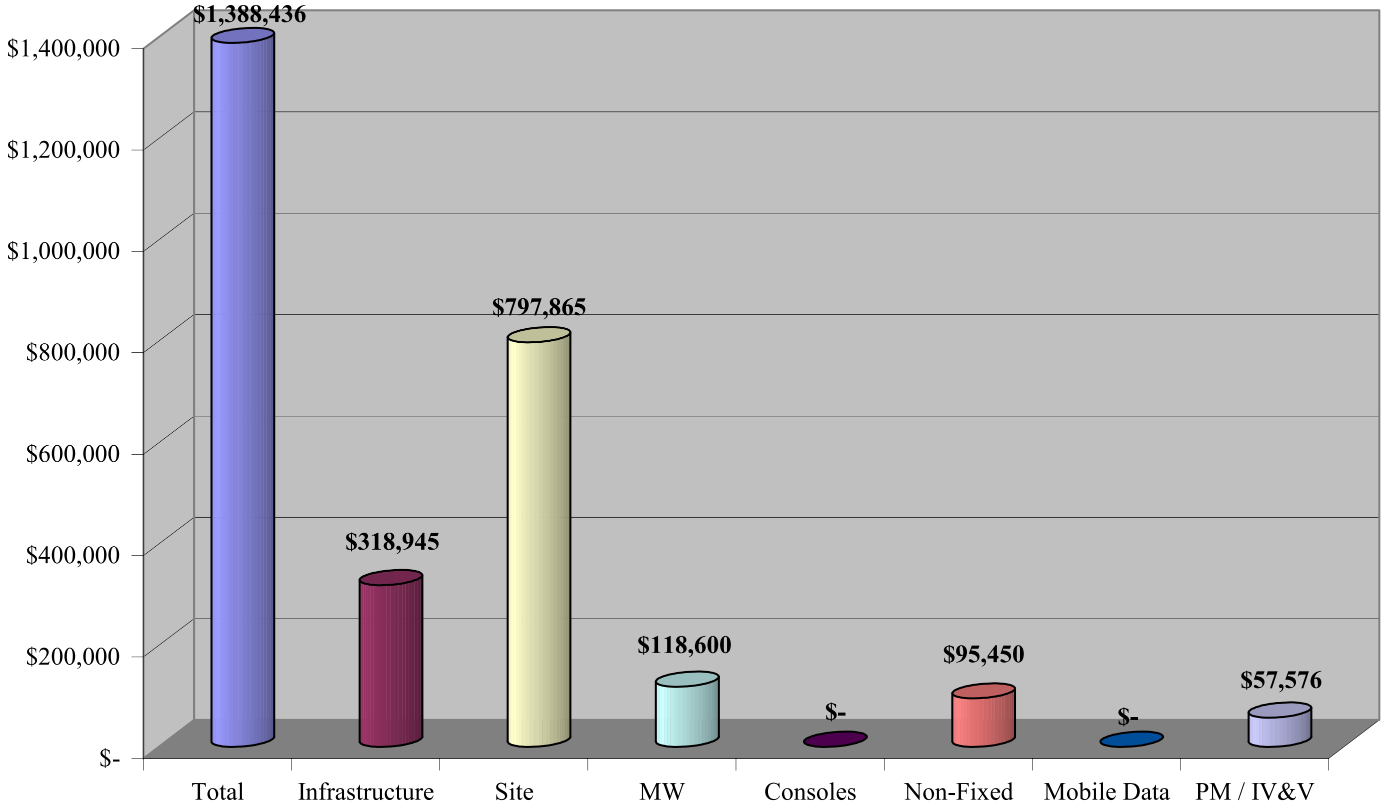


CHART 10 - 10A
SWEET GRASS COUNTY NEAR TERM ESTIMATE



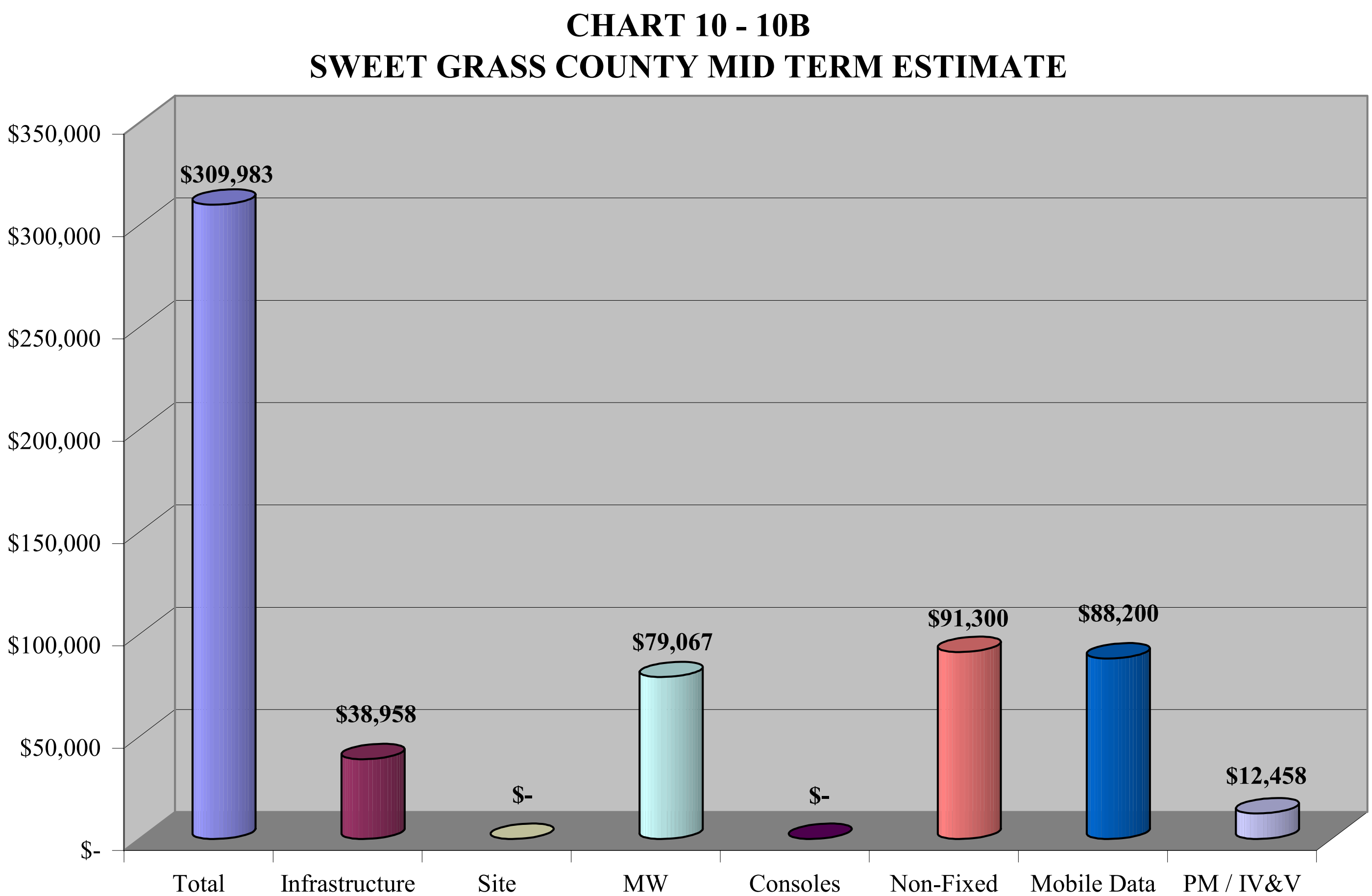


CHART 10 - 10B
SWEET GRASS COUNTY MID TERM ESTIMATE
$350,000
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$-
$309,983
$38,958
$-
$79,067
$-
$91,300
$88,200
$12,458
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

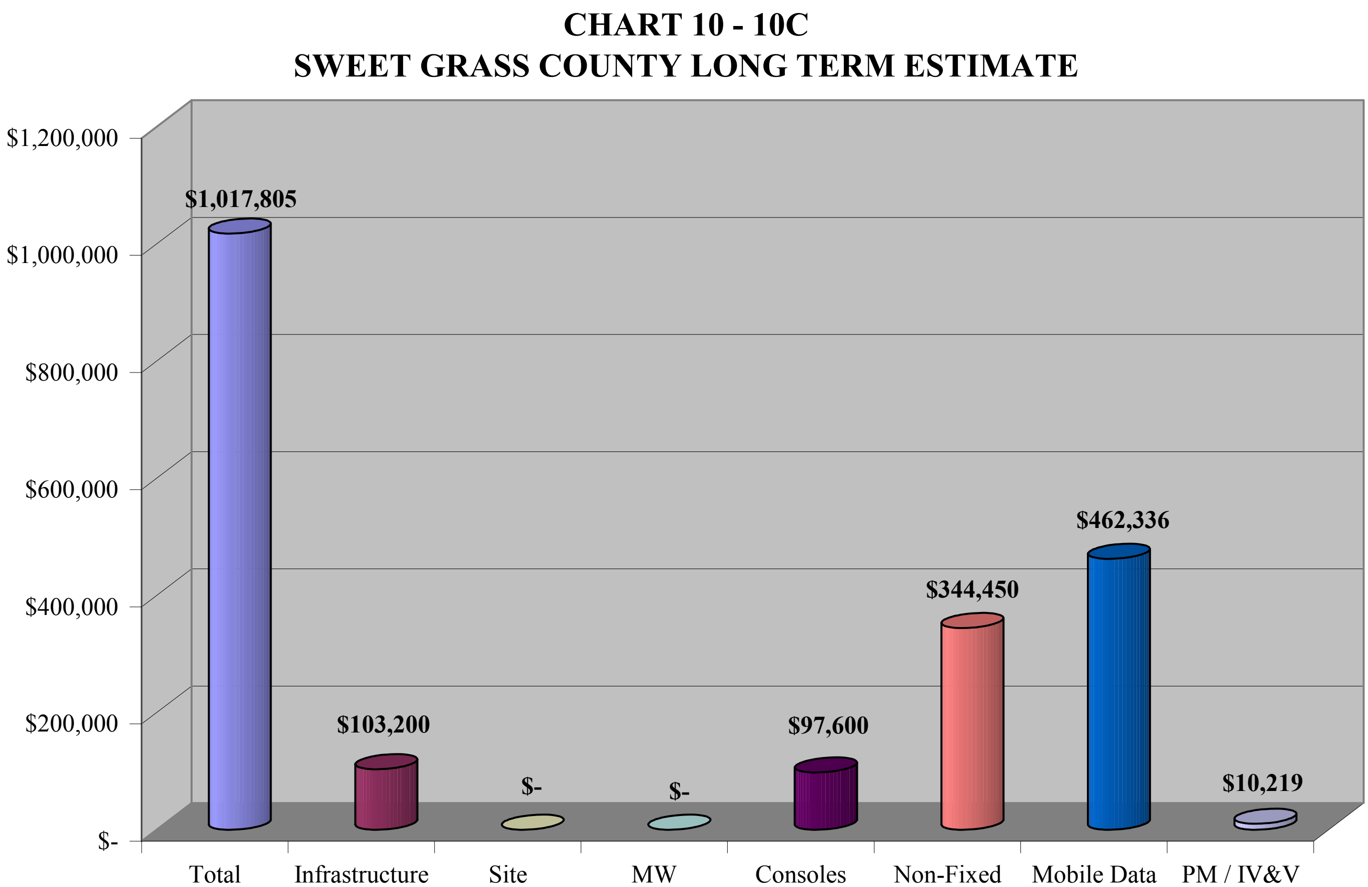
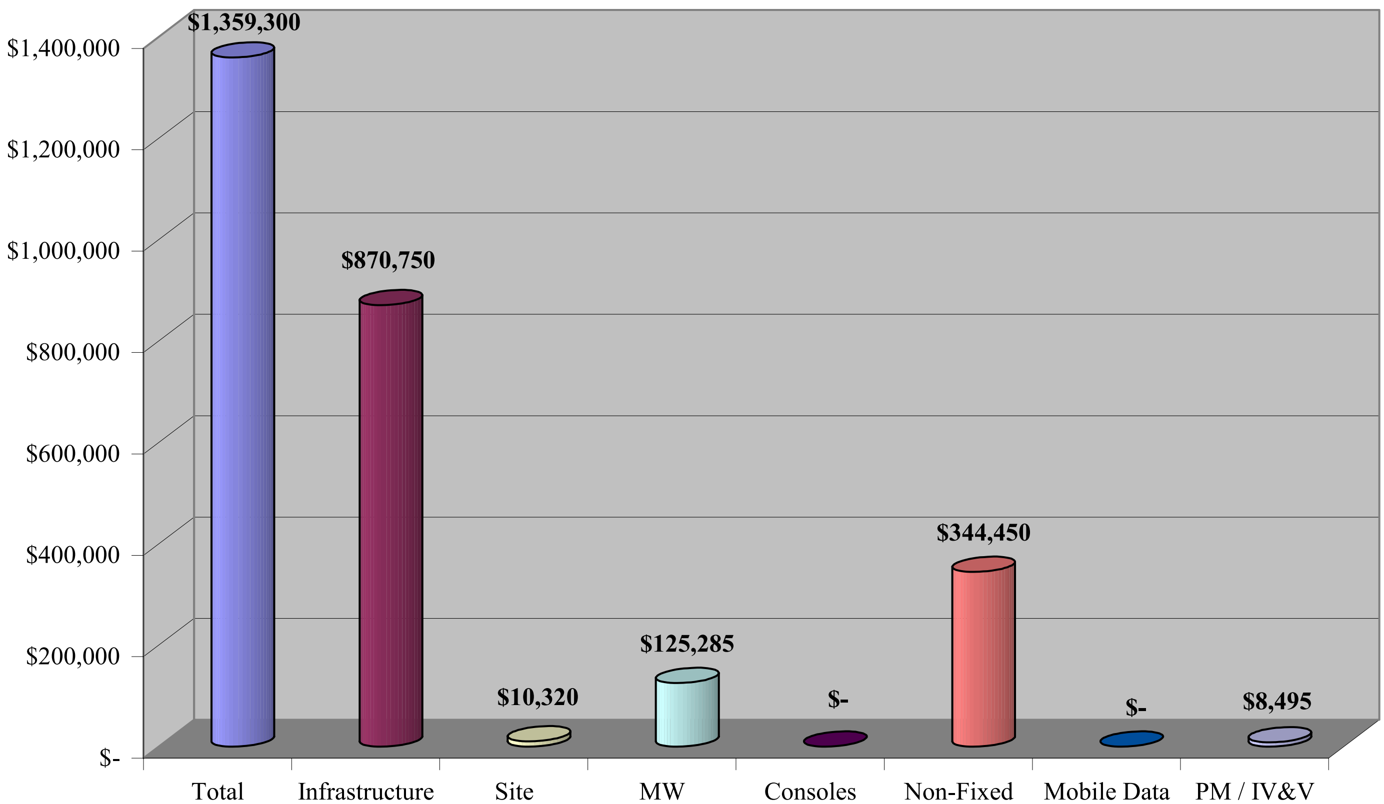


CHART 10 - 10C
SWEET GRASS COUNTY LONG TERM ESTIMATE
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$-
$1,017,805
$103,200
$-
$-
$97,600
$344,450
$462,336
$10,219
Total
Infrastructure
Site
MW
Consoles
Non-Fixed
Mobile Data
PM / IV&V

CHART 10 - 10D
SWEET GRASS COUNTY FAR TERM ESTIMATE



11.0 SUMMARY OF RECOMMENDATIONS

Contained in this document are a number of specific recommendations for the SCMIC and particularly for each county participating in the study. In fact, the entirety of this document with text, figures, tables, charts, and appendices should be viewed as our complete recommendation. While more detailed information was presented in SECTION 7 of this report, there are some basic, general areas of recommendations that are highlighted here in this summary recommendations section. These are:

- **Radio Infrastructure Technology** - CTA recommends that all SCMIC jurisdictions operate using repeater systems. CTA considers a Voting Receiver system to be a viable approach to expanding radio coverage where an imbalance occurs. It is moderately expensive, in that additional radio sites are necessary for the satellite receivers, and ongoing costs may be in effect for the telephone lines linking the receivers to the voters. A voting receiver system is generally more effective and less expensive than an additional radio site, however. CTA recommends that Receiver Voting be considered where portable coverage is an issue.

- **Radio Control Technology** - CTA recognizes the value of conventional radio systems, and that such a system is fully adequate for many users – particularly rural users with moderate communications requirements. We recommend in the near term and mid term that the conventional option be explored in every case, and trunking considered only when and where it provides sufficient operational advantages to justify the increased cost. We do not consider that trunking should be an immediate universal goal for the region, however we suggest that as near, mid, and long term upgrades roll out, they be done so as to maintain the ability to migrate to trunking in the future when appropriate and that they be reconfigurable to operate in a trunked mode where feasible. This will be a particularly important consideration as the State of Montana progresses in the planning of a Statewide VHF Trunked System. Joining that system should be a long term consideration for the SCMIC.

- **Radio Frequency Band** - Most of the rural public safety communications is currently in the VHF High Band, and as more suburban and urban areas migrate to the higher bands this frees up some additional frequencies in this band.

Equipment is reasonably priced, and there are an abundance of manufacturers available. CTA recommends that the SCMIC agencies continue to operate in the VHF band for the foreseeable future.

- **Microwave Interconnectivity Technology** - There are currently microwave systems in use in the region, and CTA recommends that these be maintained and upgraded. New microwave links can be either "licensed" or "unlicensed". CTA does not view an unlicensed spread spectrum interconnection as being public safety grade, because there are no regulatory safeguards on the interconnection. . We therefore recommend that initially spread spectrum be used on some links, with the understanding that at some future time the spread spectrum may need to be replaced by licensed equipment.

- **Narrowbanding Technology** - Recently, the FCC decided to set deadlines for the migration to greater spectral efficiency. As a result, the FCC has decided to prohibit the manufacture and importation of equipment capable of operating only in wideband - one voice channel per 25 kHz of bandwidth - after January 1, 2011. At the same time, the FCC set January 1, 2011 as the deadline for accepting any more applications for new wideband licenses and modifications to existing wideband licenses. This deadline will allow users the flexibility to maintain and expand existing wideband systems until two years before the migration deadline. The FCC also established January 1, 2013 as the deadline for wideband operations. Further Congress mandated that all federal radio systems be capable of narrowband operation no later than January 1, 2005. Both the US Park Service and the US Forest Service have narrowband capable systems and are in the process of migrating to narrowband operation. CTA recommends that the agencies of the SCMIC migrate to narrowband capable units as quickly as possible with a target of complete migration within twenty-four – thirty six months.

- **Digital Technology** - The highest level of interoperability comes when a standards-based shared system is used. Until recently, the standard mode of operation for both local, state, and federal public safety communications has been to use 25 KHz wide channels with FM modulation in an analog mode. For a number of reasons, that communications mode is no longer the standard. As described elsewhere, the regulatory requirement to move to narrowband channels is one of the factors behind the move from the current mode. Other factors include the introduction of new technology, such as trunking, and the trend towards digital communications.

P25 has been developed as the recommended standard for public safety in the United States and elsewhere. The Federal Government has adopted P25 as the standard for federal agencies. They have also instituted a requirement that any communications equipment purchased with Federal grant funds must be P25 compatible. P25 systems operate in either the conventional or trunked mode. The Montana State Interoperability Executive Council has adopted the goal of building a P25 standards based communications system throughout the State. CTA Communications recommends that the system implemented in the SCMIC be fully compatible with the state system which will combine P25 trunked and P25 digital / analog conventional technologies to provide interoperable communications among P25 narrowband digital trunked and existing conventional users. All equipment must be compatible and seamlessly integrate with infrastructure equipment deployed in CDP 1 - Southwest Interoperability Project and CDP2 - Northern Tier Interoperability Project.

- **Mobile Data Technology** - The Montana Highway Patrol Mobile Data system provide solid platform upon which to build a system that meets the needs of SCMIC users. Additional applications include such things as mapping, incident pre-plan information and so forth will be required in order to meet the needs of all public safety users. This can be done by establishing a local system interfaced with the state system. CTA Communications recommends that the SCMIC implement a local mobile data system, integrated with the state project, which will provide the additional capabilities needed. This should be done during the Long-term phase of the project. We note that Gallatin, Park, and Sweet Grass Counties are exploring the possibilities of sharing the Gallatin County CAD system. This will provide significant enhancements for relatively little cost. The State Microwave System that is being extended along I 90 will make the interconnection feasible at a relatively low cost. We encourage the counties to continue the effort.

- **Encryption Technology** - CTA recommends SCMIC users standardize on DES OFB for P25 operations, as it is typically less expensive than AES, provides excellent security, is standards-based, and allows broad vendor interoperability. Moving to AES in the future (as its price comes down) should be a software (or board change) upgrade, as all manufacturers' P25 encryption modules (the circuit board providing encryption) include both DES OFB and AES capability, in compliance with FIPS 140-2 Documents filed with US Government agency NIST, for P25 encryption certification.

If regional encrypted communications is truly desired, then a very carefully thought out key management plan is a must. As part of this plan, use of OTAR (Over the Air Re-keying) functionality should be explored to allow proper synchronization of key upgrades for cross-agency use.

- **TSB-88** - CTA recommends and will assist SCMIC in designing a radio system with consideration of the provisions of TSB-88. Initially designing the system to meet all of the actual and implied recommendations of TSB-88 may lead to over-designing the system and excessive costs. We recommend that TSB-88 be taken into *consideration* during the design of the system but that the provisions of TSB-88 be applied appropriately to the unique needs of each SCMIC jurisdiction. This act of balancing risk, reward and cost is a major reason SCMIC has retained CTA.

- **Back-up Dispatch Centers** – While outside the scope of the system design, each of the counties needs to establish a reliable back-up dispatch center. The National Fire Protection Association Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems (NFPA 1221) recommends that:

Each jurisdiction shall maintain an alternative communications facility that meets both of the following criteria:

(1) The facility shall be capable, when staffed, of performing the emergency functions provided at the communications center.

(2) The facility shall be separated geographically from the primary communications center at a distance from the alternative facility.

Each jurisdiction shall develop a formal plan to maintain and operate the alternative communications facility. The plan shall include the ability to reroute incoming alarm traffic and to process and retransmit emergency alarms.

A viable approach in the SCMIC region is for the Counties to assist each other. With the implementation of the microwave interconnectivity network between the Counties there will be the ability to transfer and handle radio and even telephone calls in another County.

This can lead to multi county back-up arrangements where the Counties agree to provide disaster recovery assistance in times of need. The region is well-known for assisting each other and should continue that tradition here as well.

- **Dispatch Facilities and Staffing** – As part of the effort to improve the communications, each of the dispatch centers in the SCMIC region is in need of additional space and upgrading. As the operations become more computerized, additional space must be made available for the equipment needed. The lack of available space is limiting the ability of the centers to staff according to the actual demand. Each agency with a dispatch center needs to address the space needs of their dispatch center.

- **Operational Issues – Procedures and Training** - Procedures and training in those procedures are as important an element of interoperable communications as is the communications system itself. There is a need to improve the procedures used and to raise the level of training of the personnel involved.

- **Public Warning and Alerting** – During the course of our interviews for this project, several individuals and organizations expressed concern at the lack of public warning systems in the area. CTA recommends that the SCMIC explore the implementation of a wide-area notification system, commonly known as "Reverse 911". These systems use a data base of listed telephone numbers to make multiple calls simultaneously to distribute notifications from public safety officials. The systems are designed so that an area of any size can be selected and a message recorded then rapidly delivered to the selected area. Because these systems generally only have access to listed telephone numbers and people must be home to receive the message, any such system must be part of a combination of methods to warn the public. In some areas, outdoor warning sirens may be appropriate. However, the sirens have a limited range and effectiveness. In addition, they are expensive to install and maintain. The Emergency Alert System, formerly know as the Emergency Broadcast System, is another means of warning the public.

  Through this system, messages are broadcast over radio and television stations. In order for this to be effective, people have to be listening to a local station. A fourth method of communication is the National Oceanic and Atmospheric Administration's (NOAA) Weather Radio System.

Through NOAA Weather Radio, emergency messages can be broadcast to users equipped with receivers on the NOAA channel serving the area. There are several stations serving the region, but coverage is not complete and people have to have a receiver in order to receive the information. In addition to deploying a regional wide area telephone notification system, we recommend that emergency management officials in the region cooperative develop a regional warning plan using the Emergency Alert System and NOAA Weather Radio, supplemented by outdoor warning sirens where appropriate.

TABLE 11-1 provides a concise description of our Near Term, Mid Term, and Long Term recommendations for each key area of the SCMIC study.

Recommendations for each County are provided in summary form. If no county is mentioned in a table entry, that recommendation applies across each of the 5 SCMIC counties

CTA has attempted to balance engineering design and judgment, current system considerations, Local, County and State inputs, a near to long term realistic view of system migration, while providing the best solution for the projected costs.

As in any high level design effort, many additional details will need to be determined before equipment would be ordered and implementations begun. For example, detailed site planning for new recommended sites, microwave path optimization, detailed channel usage and sharing plans, and detailed loading analysis including growth projections, would be part of a detailed design phase.

In completing this high level design effort for each County and the SCMIC region, SCMIC participants have a roadmap for improving interoperability and radio system performance now and into the next decade.

We have also described in SECTION 7, and again in the individual County's sections, a regional procurement, implementation, and maintenance approach that we feel will provide benefit to all jurisdictions:

- Cost benefits, resulting from the increased power of joint participation and from competitive forces

- Service benefits, resulting from competition and oversight

- Technology benefits, resulting from obtaining equipment and service from vendors that are focused on the specific technologies being purchased

In this approach, we suggest that the region procure radio infrastructure, subscriber (non-fixed) radio equipment, microwave, mobile data, and physical facilities separately rather than on a single turn-key contract. We also suggest that the region procure maintenance services jointly.

While we concur that this process will require some additional technical and procurement oversight, we have found in our experience with similar projects that the cost, service, and technology benefits for our clients have far outweighed the relatively nominal costs of the oversight.

Again, we wish to thank all of the agencies which participated in this study for their cooperation and support. It was obvious from the knowledge and enthusiasm of the individuals with whom we met and interviewed that they are all cognizant of the importance of working together to solve their joint communications problems. The agencies and departments provided us with open access to their personnel and to their facilities. We especially wish to express our thanks and appreciation to the SCMIC representatives for both the professional manner in which they organized our meetings and interviews, and the friendly and efficient way in which they responded to our needs in preparing this report.

TABLE 11-1 Near Term, Mid Term, and Long Term recommendations					
GOALS	IMMEDIATE	NEAR TERM	MID TERM	LONG TERM	FAR TERM
	Site Reliability	Improve Coverage			
	Critical Subscriber Equipment	Interoperability	Interoperability		Interoperability
		Non-Fixed	Non-Fixed	Non - Fixed	Non-Fixed
		Interconnectivity	Interconnectivity		Interconnectivity
		Paging	Paging	Paging	
		Consoles		Consoles	
		Mobile Data	Mobile Data	Mobile Data	
				Encryption	Encryption
		Maintenance	Maintenance		
	IMMEDIATE	NEAR TERM	MID TERM	LONG TERM	FAR TERM
Improve Coverage	Site Reliability	Add Sites, & Voting			
Interoperability		Interoperability Repeaters	Complete Interoperability Repeaters		Convert to P25 State trunking
Non-Fixed	Critical Subscriber Equipment	Replace Old Equipment Purchase Required New Equipment	Replace Remaining Old Equipment	Lifecycle Replacement with Trunking Radios	Lifecycle Replacement with Trunking Radios
Interconnectivity		Begin installation of Microwave Network	Complete Microwave Network		Add MW Connections to State System
Paging		Gallatin Paging Upgrade	Digital Paging	Two-way paging	
Consoles		Madison Consoles		Replace consoles	
Mobile Data		Use State System - Gallatin County	Use State System - Gallatin County -Park County Sweet Grass County	Independent System - Gallatin County - Madison County - Meagher County - Park County - Sweet Grass County County	
Encryption			Encrypted Channels Common Standard	Encrypted Channels Common Standard	Encrypted Channels Common Standard
Maintenance	Create Joint Counties Purchasing	Create Maintenance Committee	Create Joint Maintenance Operation		

APPENDIX A TECHNOLOGY OVERVIEW

This document is intended as a general technology tutorial to accompany the Interoperability Report. The scope is wide and covers many technological areas. Many are of informational use only for the SCMIC environment. However, it is advisable for the SCMIC agencies to be aware of the general communications environment.

A.1 FREQUENCY BANDS

Land Mobile Radio (LMR) operates currently in one of five frequency bands, each of which has unique characteristics. CTA has considered all frequency bands in our analysis, and we have made specific recommendations in each case. In general, the applicability of a frequency band to a particular situation is based on the following criteria:

- Availability of Frequencies in that band
- Amount of current legacy equipment in that band
- Interference to/from other users in that band
- Technical characteristics of the band – radio propagation, noise floor, structure
- Expense of the equipment used for that band

Below we describe each frequency band in terms of these criteria.

A.1.1 VHF Low Band – 25-50 MHz

VHF Low band can propagate easily for great distances, and it is the least affected by terrain characteristics. This is a feature, in that it can be used by people who travel substantial distances in mountainous areas. This is also a drawback, in that interfering signals also travel great distances and either override the wanted signal or present annoying sounds to the user. It can be affected by the ionosphere, which is more of an interference mechanism than a communications mechanism. Interference from as far away as 800 miles is not uncommon, particularly during periods of high sunspot activity. Limited frequencies are available, which generally precludes repeater use, and so most of the operation is simplex – direct between one radio and another. Low Band antennas are large, which makes it difficult to use for portable radio equipment, and even for some vehicles.

The band is unstructured, and generally set up for simplex rather than duplex/repeater channels. Radio noise in this band is an ever increasing problem: much of the recent electronic equipment operates with clock rates commensurate with VHF low band which means in all but very rural areas noise levels are getting high enough to affect communications. Equipment is inexpensive, but because of the interference and noise some manufacturers are abandoning the band.

A.1.2 VHF High Band – 138-174 MHz

VHF High Band propagates well in rugged terrain, but does not propagate to as great a distance as Low Band. Interference is pretty much limited to users within 70 to 100 miles away, which are reasonably defined. High Band is seldom affected by the ionosphere. Limited frequencies are available, however due to the narrow-banding of frequencies below 512 MHz, additional frequencies are becoming available. High Band is also unstructured, which makes it difficult (but not impossible) to use for more sophisticated configurations such as trunking applications. The band was not originally structured with the intent of having repeaters; however most of the operation in High Band is now repeater operation. Most of the rural public safety communications is currently on VHF High Band, and as more suburban and urban areas migrate to the higher bands this frees up some additional frequencies. Equipment is reasonably priced, and there are an abundance of manufacturers available.

A.1.3 UHF – 450-512 MHz

UHF propagates well in rolling terrain, but tends to be affected by large and sharp terrain features – at least more than High Band. It also penetrates buildings better than VHF due to the shorter wavelength. Rarely are interfering users further away than 60 to 70 miles. This is a structured band, in that there is typically a 3 or 5 MHz separation between transmit and receive frequencies, and these transmit/receive frequencies are normally licensed as pairs. This makes sophisticated configurations such as trunking more realizable. It is assumed in UHF that the systems will be operated in a repeater configuration. Some rural public safety communications are currently in the UHF band, but this is by no means universal. Narrowband frequencies have been available for some time, and therefore are generally already taken in many areas.

The 470 to 512 MHz portion of the band coexists with several UHF television channels, and so its use is restricted to locations in the general vicinity of metropolitan areas. Equipment is reasonably priced, and there are an abundance of manufacturers available.

A.1.4 800 MHz Band

The 800 MHz band was specifically set up for trunking operation. It is fully structured, with 45 MHz separation between transmit and receive frequencies. Propagation is limited, and it is sharply affected by terrain features. It does penetrate buildings well due to the short wavelength.
Characteristics are similar to those of Cellular Telephone in the same band. It is most useful in high density areas where there are a lot of communications taking place. 800 MHz is currently going through a "re-banding" process, in an attempt to minimize and eliminate interference from Cellular operators – most notably Nextel – and other users, particularly public safety users.

800 MHz is split into two types of channels, those currently in the 806-821 MHz range, and those currently in the 821-824 MHz range (with corresponding frequency matches 45 MHz above). These sub-bands will change frequencies during the re-banding process, but for purposes of this discussion the information will remain the same. The 806-821 MHz sub-band was populated first, with public safety interleaved with other users. The 821-824 MHz sub-band (NPSPAC) was populated about 10 years later, and is dedicated to public safety only. The bands have different rules, and different licensing requirements, but for the most part the characteristics are pretty much the same.

Despite the fact that there are a great deal of available frequencies in the 800 MHz band, CTA suggests that 800 MHz is applicable mostly to urban or suburban jurisdictions. We do not recommend that the systems be designed around the 800 MHz concept, nor that 800 MHz be a target for long term design.

A.1.5 700 MHz Band

700 MHz has technical characteristics virtually identical to 800 MHz. It differs only in the way it is being administered and licensed. The 700 MHz band is being created by the migration of UHF channels 60 to 69 to other bands concurrent with conversion to High Definition TV (HDTV).

The requirement is that the TV stations be moved to the new location prior to issuing licenses to public safety users, which is happening at a rate slower than anticipated by the FCC. There is a major push from the Public Safety community to speed this process up.

Interest in 700 MHz is strongest where 800 MHz frequencies have all been used up, which is generally in the most metropolitan areas of the country. The band will be structured, similar to the 800 MHz band, however in addition there will be flexibility for concatenating channels together to provide wideband channels that will support high speed data.

CTA suggests that the main use for the 700 MHz band for the SCMIC region will be in the future as a potential vehicle for high speed data. We do not recommend that SCMIC take any action in this band, with the exception of monitoring the process and making sure that they have frequencies set aside in the event that they wish to use them.

A.2 RADIO SYSTEM DESIGN TECHNOLOGIES

Throughout this document, we have used and commented on several system configurations. In this section we will describe these configurations, and advise on which are applicable under what circumstances.

A.2.1 Repeater Systems

The most basic form of communications between radios is direct, or “simplex” communications where the user of a radio (mobile, portable, or desktop) speaks into that radio, and the signal is received on another radio for another user. The typical “consistent” range of this type of communication is from two to eight miles, depending on the location of the two radios, the type and elevation of the antennas, and other radio characteristics.

In order to extend the communications range, a repeated or “duplex” approach is taken. At a well situated site – frequently on a mountain, with a tower to provide elevation for the antenna, the operator places a radio repeater connected to a high efficiency antenna. The radio repeater consists of a transmitter and a receiver that are interconnected so that a received signal is automatically retransmitted.

The transmitter and receiver may be connected to a single antenna using a duplexer, or in some large sites may be connected to separate antennas. In order to be able to operate, the received frequency must be different than the transmitted frequency. The antenna is generally elevated above the average terrain, with elevations from 150 feet to 1000 feet (using a mountaintop) not being uncommon. Thus, a radio user speaks into their radio, the signal is sent to the radio repeater where it is retransmitted, and received by the other user(s).

The effect of the repeater system is to increase the operating distance considerably. The consistent range between a repeater and a mobile or portable radio is generally from 10 to 25 miles or more, which means that two mobile or portable radios could communicate with each other despite being separated by 50 or more miles, a considerable improvement over the "simplex" approach.

CTA recommends that all SCMIC jurisdictions operate using repeater systems.

A.2.2 Conventional Radio Systems

In a Conventional architecture, a separate frequency is used for each channel of communication. To hear transmissions destined for your operational group, you need to be tuned to that specific frequency. In most situations multiple operational groups will share a frequency, meaning that it is necessary to listen to the frequency to make sure no-one else is speaking before making your transmission.

The term "Conventional" only became necessary in order to differentiate from "Trunking". Conventional systems were the only ones available prior to the advent of trunking.

Conventional radio equipment is relatively simple and inexpensive, and in many cases vendor-neutral.

CTA recognizes the value of conventional radio systems, and that such a system is fully adequate for many users – particularly rural users with a moderate communications requirement. We recommend in the near term and mid term that the conventional option be explored in every case, and only when it is exhausted (generally because of an absolute limit of frequencies), should more expensive options be pursued.

A.2.3 Voted Receiver Systems

In many situations, notably those where low power portable radios are in use, the "talk back" distance is significantly less than the "talk out" distance. Thus, where a higher powered mobile radio might be able to talk to, and receive from a particular repeater to a distance of 25 miles, a portable radio would be limited to 8 miles of talk-back to the repeater, and 20 miles of talk-out from the high powered repeater to the portable.

Effectively, this talk-out/talk-back imbalance limits the portable use to a total distance of 8 miles from a base or repeater. Since the transmitter power of the portable is by nature of the device limited to being low power, dispersing additional receivers throughout the region is an effective way to balance the distances. Thus, a region might be served by a single high powered fixed transmitter, and three or four receivers located throughout. One receiver is generally collocated with the fixed transmitter, and the others would generally be located 8 to 12 miles away.

A portable radio that is keyed up and transmitting may be received by one or more of these "satellite" receivers. The closest receiver will generally produce the best signal. The signals from each of these receivers are typically brought to a central point using telephone lines or some other means of transmission, and there a device called a "Voter" examines the signals from all receivers. The best signal is selected, and this is the one provided to the repeater transmitter. Thus, the area served by a lower powered portable can be made commensurate with that served by a higher powered mobile radio.

CTA considers a Voting Receiver system to be a viable approach to expanding radio coverage where an imbalance occurs. It is moderately expensive, in that additional radio sites are necessary for the satellite receivers, and ongoing costs may be in effect for the telephone lines linking the receivers to the voters. It is generally more effective and less expensive than an additional radio site, however. CTA recommends that Receiver Voting be considered where portable coverage is an issue.

A.2.4 Transmitter Steering

Another system configuration that attempts to inject both intelligence in the design, and focuses on the conservation of radio spectrum is "transmitter steering". In many wide-area systems, the user must keep track of where he is physically and make adjustments in the channel selection as he roams through the territory. A "wide area" system is by definition a collection of two or more radio sites where a single site cannot provide the requisite coverage. This is distinguished from a "voted" system in that more than one "transmitter" site (base to mobile) is required. (A "voted" system will have multiple receive sites, but can have a single transmitter site.) A system where voting takes place in the mobile-to-base path (multiple receive-only sites), but the user must choose the transmitter (by frequency) based on location is often termed "multi-cast". The user may know, for instance, that when he is west of route 663 and north of route 35 he should switch to channel # 3.

An alternative to this manual switching, which forces the user to think about the channel selected, is "transmitter steering." In this configuration, the system has been built with a voted network for the receive frequency (or frequencies). If the transmitters are co-located with the receivers at the various tower sites, the engineer is afforded an opportunity to utilize information from the received signal to locate the user. From the received signal strength indication (RSSI) obtained from the "comparator" (or "voter", depending on manufacturer), we can deduce where the subscriber radio is located (at least in a general sense). If there are four sites in our configuration, and the RSSI from site # 3 is the strongest, we can include logic in the system controller that will steer the outbound message (base-to-mobile) to the transmitter located at site # 3. This routine can relieve the user of the extra task of tracking himself and manually selecting the channel on his radio. It will also assure that we have the best (i.e., strongest) signal available, maximizing our probability of satisfactorily completing the call. And finally, it conserves spectrum since only the single, optimum frequency (at the best site for the call) is used on each call.

A.2.5 Simulcast Systems

The nature of a radio signal is that it diminishes in strength as it travels from the radio transmitter outward. It is also affected by terrain features such as ridges and mountains, and its effectiveness is sometimes compromised by interference and electrical noise. In any event, there comes a point where a repeater transmitter simply cannot communicate into a particular area or beyond a particular point.

The only means of expanding the coverage area in this situation is to add radio transmitters (and receivers as described above under "Voting Receiver Systems"). The simplest solution is to place another repeater in the area with coverage problems, and then select one or the other repeater depending on where the subscriber is located. This is indeed viable in many situations, however if there are multiple radio channels involved, and three or more areas with repeaters, it becomes operationally cumbersome.
In addition, it is a very inefficient use of the radio spectrum and sufficient frequencies may not be available to support this configuration.

"Simulcast" is the process where multiple transmitters using the same radio frequency are simultaneously activated in different locations. This is not a trivial undertaking – unless they are carefully integrated in a "Simulcast" configuration, they will interfere with each other and cause more problems than they will solve.

A simulcast configuration requires that the transmitter frequencies be absolutely identical, that the audio launch times (audio delay) between radio sites be strictly controlled, and that the transmitter modulation characteristics be identical among all transmitters in the system. This requires control of every element in the system – the transmitters, the transmission medium to the transmitters, and the effects of the intervening terrain. It is a fairly complex undertaking, made more technically and operationally feasible by the recent use of GPS satellite technology.

While Simulcast is substantially more expensive than simple repeaters, it is frequently less expensive than a multiple site trunked system which might serve a similar purpose.

It will be driven by operational requirements (it is essentially transparent to the user, whereas multiple radio sites with different frequencies will require much user activity and knowledge of location to be effective), and also by frequency availability. In the end, it may become the only viable solution, and the user will be faced with either expending the funds or operating on a limited radio system.

CTA recommends in the near term, mid term, and long term that simulcast be explored where frequency limitations exists and operational requirements will benefit from its use.

A.2.6 Trunked Radio Systems

The primary driving force behind trunked radio systems is the efficient use of the radio spectrum. Most moderate sized government operations need several radio channels – typically one or more for fire, for law enforcement, for emergency medical response, and also one or more for general government use. As the operations grow they require additional communications capacity. In a Conventional system this would require additional radio channels, which in many situations are simply not available.

In a Trunked Radio System, a small number of radio channels are shared among a large number of users. A computer directs groups of users (talk-groups) to available channels as needed, packing them into the available physical channels in a highly efficient way. Users only hear units in the same "talk group". This process permits substantially more users to be served (a factor of three to four times as many as in a conventional situation) by the same number of physical channels since most users do not need their channel 100% of the time.

While the primary purpose of trunking technology is spectrum efficiency, the commercial manifestation of this technology has used the technology to provide many additional features. Trunked systems can track users over wide areas, automatically applying multiple site resources to dispersed talk groups, while limiting the number of sites involved when a talk group is contained in a local area. Trunked systems are scalable, so that as the communications needs increase it is a simple matter of adding a channel to increase capacity. Trunked systems can prioritize talk groups, so that when an emergency arises that is communications intensive, the critical groups responding to the emergency are guaranteed access.

Trunking systems are inherently expensive. The fixed infrastructure requires not only the radio repeaters of a conventional system, but also the computers, inter-site communications, system management, and alarms necessary for their operation. Currently once a vendor is selected for the fixed infrastructure, additional fixed equipment can only be purchased from that vendor. The subscriber equipment is complex, generally specific only to the protocols for the particular fixed system, and therefore also expensive.

We do not consider that trunking is an immediate answer to the SCMIC communications environment. However we suggest that as near, and mid term upgrades roll out, they be done so as to include trunking in the future. This will be a particularly important consideration as the State of Montana progresses in the planning of a Statewide VHF Trunked System.

A.3 ENCRYPTION

LMR vendors provide a number of unique and non-compatible encryption protocols for their land mobile radio products. A brief explanation of the commonly used encryption algorithms follows, as well as recommendations for encryption for new P25 digital systems.

Digital encryption is by its nature a very complex process. The important point for radio security is that DES and AES provide virtually unbreakable security as long as the encryption key (the 64 bit (DES) or 256 bit (AES) number which uniquely controls the encryption or ‘bit scrambling’ of digitized voice data by the algorithm) is kept private, and no radios with active keys have been lost or stolen.

DVP (Digital Voice Privacy), which has been widely used in the SCMIC area over the years, is the original algorithm that Motorola introduced in the late 1970’s for high end public safety products. DVP’s synchronization technique caused bit error extension (one bit in error propagates the next 64 bits as errors), and thus range loss, of about 30 to 50%.

DES (Data Encryption Standard) is a Federal Government backed standard, introduced for computer data security in the mid to late 70’s for sensitive but unclassified information. The initial versions of Motorola DES products also had range loss due to cipher feedback (CFB) mode of operation (self-synchronization).

AES (Advanced Encryption Standard) is the latest US Government encryption standard for unclassified information. It uses a 256 bit key, and operates in output feedback (OFB) mode for voice security without range loss.

To correct the range loss of cipher feedback mode (GE Mobile Radio had introduced Voice Guard, utilizing DES-OFB mode in 1985, offering no range loss), Motorola produced DVP-XL and DES-XL, which use a synchronization header, and a non bit error propagating mode ("counter-addressing") for the DVP and DES algorithms.

P25 has defined DES-OFB, and the more recent AES (the US Government (FIPS 140-2) approved "Advanced Encryption Standard") algorithms for P25. A manufacturer must certify that their equipment has been validated to meet Federal Standard FIPS 140-2 for DES and/or AES encryption before they can sell to Federal Agencies.

CTA recommends SCMIC users standardize on AES for P25 operations, as it is provides excellent security, is standards-based, and allows broad vendor interoperability. Additionally moving to AES in the future (as its price comes down) should be a software (or board change) upgrade, as all manufacturers' P25 encryption modules (the circuit board providing encryption) include both DES OFB and AES capability, according to FIPS 140-2 Documents filed with US Government agency NIST, for P25 encryption certification.

There are numerous manufacturers of P25 digital conventional radios, offering interoperable encryption according to the P25 Standard. These include Motorola, M/A Com, EF Johnson, Kenwood, Datron, RELM (BK Radio), and Thales. The manufacturers with FIPS 140-2 validated AES implementations include Motorola, M/A Com, EF Johnson, RELM, and Thales (as of May 2005).

While any of these radios are able to work over Motorola repeaters, and communicate with Motorola P25 mobiles and portables, there will be different peripheral interfaces including the encryption related interfaces for microphones, Radio Programmer, Antennas, Key Loaders, etc., and maintenance of multiple manufacturer's equipment will be necessary. This is not necessarily a negative - the users are, however, cautioned to carefully trade off all costs associated with implementing a "mixed" system.

In addition to hardware interoperability, different user groups, agencies, Counties, etc. must develop a plan for utilizing a common encryption key in order to achieve voice communications interoperability in the encrypted mode.

Since the key is what keeps the communications secure, key management becomes a potential weak point in potential compromising of security. The more individuals involved, the more likely intentional or unintentional release of a key, could become.

If regional encrypted communications is truly desired, then a very carefully thought out key management plan is a must. As part of this plan, use of OTAR (Over the Air Re-keying) functionality should be explored to allow proper synchronization of key upgrades for cross-agency use.

A.4 INTERCONNECTIVITY

Interconnectivity is defined as the connections between communications sites. This includes connections between radio sites and the communications centers, and also connections between and among communications centers throughout the region. The following paragraphs discuss the different types of interconnectivity available, and the applicability of each to this group of systems.

A.4.1 Microwave

Generally speaking, microwave operates from about 2 GHz to 38 GHz, in several discrete bands. Each band has its own propagation characteristics. The 2 GHz band is in the process of being abandoned for purposes of interconnectivity, to make way for use in other services such as cellular and unlicensed services. At that point, the FCC Part 101 bands for microwave will be 6 GHz, 10 GHz, 11 GHz, 18 and 23 GHz. The higher frequencies are shorter range, and at 18 GHz and above there is some effect on the signal by heavy rainfall.

There are currently microwave systems in use in the region, and CTA recommends that these be maintained and possibly upgraded. New microwave links can be either “licensed” or “unlicensed”.

A.4.1.1 Licensed Spectrum

Part of the microwave spectrum is separated into microwave channels, which are controlled by the licensing process of the FCC. This means that the FCC “guarantees” the absence of interference, and will not license another user in such a manner as to interfere with a current licensee. The advantage to the user is that they can feel secure that the microwave link will always be available.

Microwave equipment in the licensed spectrum is generally more expensive than in the unlicensed spectrum by a factor of three to four. The licensed microwave has more features and options, however, and lends itself to high reliability operation.

The FCC Rules, Part 101 for the use of microwave transmitters in the bands above 3 GHz for common carriers and private operational fixed users are contained in Title 47 of the Code of Federal Regulations. Part 101 consolidates the old Part 21 and Part 94 rules into one set of rules for both common carriers and private operational fixed users. All frequency bands under Part 101 are available for both types of user. These frequency bands provide the owner flexibility and choice in the area of telecommunications transmission infrastructure design engineering.

There are three prevalent microwave-signaling technologies utilized in North America today for public safety, state and local government applications. The oldest technology is the analog platform and it utilizes Frequency Division Multiplexing signaling.

The second technology is the digital PCM, or Pulse Code Modulation signaling hierarchy. The third application is the SONET, or Synchronous Optical Network. In addition, there is the Spread Spectrum Technology that can be utilized in applications that do not warrant FCC frequency license protection.

A. Analog Technology

Analog (FM/ FDM) microwave dominated the North American private and state, and local market in the 1960's. It is still used today to support radio, and telephone and traffic. It is limited in its ability to support data circuits. Considerations in the design of an analog microwave radio system require that noise in the voice channel be minimized as much as possible.

B. Digital TDM/ PCM Technology

The North American digital hierarchy was developed utilizing Time Division Multiplexing (TDM) and Pulse Code Modulation (PCM) technology. The digital building block is based on 8000 samples per second multiplexing. These 8000 samples per second form the digital 8-bit sample frame.

The Digital Hierarchy Standard (TDM & PCM) is defined by the T1.102-1993 American National Standard for Telecommunications - Digital Hierarchy-Electrical Interfaces. The evolution of digital microwave transmission in North America began around 1970. Digital transmission was developed to cope with application problems generated by analog technology.

Each terminal in the system is running from its own time source or clock. In digital transmission, clocking is one of the most important considerations. Clocking refers to the use of a series of repetitive pulses to keep the bit rate of data constant and to indicate where the ones and zeroes are located in a data stream.

Since these clocks are free running and not synchronized, large variations occur in the clock rate and thus the signal bit rate. Asynchronous multiplexing uses multiple stages. Signals such as asynchronous DS–1s are multiplexed, and additional bits are added (bit-stuffing) to account for the variations in the individual stream and combined with other bits, known as framing bits, to form a DS–2 stream.
Bit-stuffing is re-applied to multiplex to the DS–3 level. DS–3s are multiplexed up to higher rates in the same manner. At the higher asynchronous rate, they cannot be accessed.

C. SONET

SONET is a technical standard for implementation of a transport technology with industry. It provides an industry standard interfaces operating environment with defined protocols for operations management, provisioning, and performance assurance. The SONET- base standard is defined by the T1.105-1991 American National Standard for Telecommunications - Digital Hierarchy-Optical Interface Rates and Formats Specifications (SONET). The ITU-T (formerly CCITT) adopted SONET as the basis for its SDH (Synchronous Digital Hierarchy) transport system. Currently, SONET is a North American subset of the ITU's SDH. The SONET- base standard T1.105-1991 document is currently being rewritten and enhanced into several smaller standards. Synchronous optical network (SONET) is a standard for optical telecommunications transport.

This technology is also utilized in microwave radio technology. SONET defines a technology for carrying many signals of different capacities through a synchronous, flexible, optical hierarchy. This is accomplished by means of a byte-interleaved multiplexing scheme. Byte-interleaving simplifies multiplexing and offers end-to-end network management.

In a set of synchronous signals, the digital transitions in the signals occur at exactly the same rate. All the clocks are traceable to one primary reference clock. If two digital signals are plesiochronous, their transitions occur at almost the same rate, with any variation being constrained within tight limits. For example, if two systems must work together, their clocks may be derived from two different primary source clocks. Although these clocks are extremely accurate, there is a difference between one clock and the other. This is known as a plesiochronous difference.

Asynchronous multiplexing uses multiple stages. Signals such as asynchronous DS–1s are multiplexed, and extra bits are added (bit-stuffing) to account for the variations of each individual stream and combined with other bits (framing bits) to form a DS–2 stream. Bit-stuffing is used again to multiplex up to DS–3. DS–3s are multiplexed up to higher rates in the same manner. At the higher asynchronous rate, they cannot be accessed without demultiplexing.

The average frequency of all clocks in the system will be the same (synchronous) or nearly the same (plesiochronous). Every clock can be traced back to a highly stable reference supply. Thus, the STS–1 rate remains at a nominal 51.84 Mbps, allowing many synchronous STS–1 signals to be stacked together when multiplexed without any bit-stuffing. Thus, the STS–1s are easily accessed at a higher STS–N rate.

Low-speed synchronous virtual tributary (VT) signals are also simple to interleave and transport at higher rates. At low speeds, DS–1s are transported by synchronous VT–1.5 signals at a constant rate of 1.728 Mbps. Single-step multiplexing up to STS–1 requires no bit stuffing, and VTs are easily accessed.

We recommend that any licensed microwave links be engineered in redundant configurations to protect against single-point failures and outages that may impact public safety operations.

A.4.1.2 Unlicensed Spectrum (Spread Spectrum)

In addition to these licensed applications, the FCC has established rules for the use of spread spectrum transmitters in the Industrial, Scientific, and Medical (ISM) bands. These transmitters can operate without the FCC license documentation. The FCC rules for spread spectrum applications are contained in Title 47 of the Code of Federal Regulations (otherwise known as the FCC Rules), Part 15.247. The FCC has allocated the 2.4 GHz band and the 5.8 GHz band for unlicensed voice and data applications.

Spread spectrum is a coding technique for digital transmission that was developed for military purposes. The purpose of coding is to transform an information signal so that it looks more like noise. The spread spectrum coding technique modifies the signal spectrum to spread it out and expand its bandwidth. The expansion of the transmitter bandwidth minimizes interference to others because of its low power density. In the receiver, the incoming signal is decoded, and the decoding operation provides resistance to interference and multipath fading. Usually, spread spectrum is implemented using two distinct processes. These processes are frequency hopping and direct sequence.

In systems that use frequency hopping techniques, the carrier frequency of the transmitter abruptly changes ("or hops") in accordance with an apparently random pattern. This pattern is in fact a pseudo-random code sequence. The order of the frequencies selected by the transmitter is taken from a predetermined set as dictated by the code sequence. The receiver tracks these changes and produces a constant IF signal. Interfering signals are not tracked. Therefore they only occasionally fall within the IF bandwidth of the receiver.

In direct sequence systems, the carrier phase of the transmitter abruptly changes in accordance with a pseudo-random code sequence. This process is generally achieved by multiplying the digital information signal with a spreading code, also known as a chip sequence. The chip sequence has a much faster data rate than the information signal and so expands or spreads the signal bandwidth beyond the original bandwidth occupied by just the information signal.

At the receiver, the information signal is recovered by re-multiplying with a locally generated replica of the spreading code.

Interfering signals are reduced by the process gain of the receiver. They are spread beyond the desired information bandwidth by the second multiplication process (in the receiver) and then removed by filtering.

The FCC determined that since these signals can coexist without interference, there is no point in licensing them (licensing being the means of reducing or eliminating interference), and so this is called "unlicensed spectrum". This means that the equipment needs only to be purchased, installed, and operated. Spread spectrum equipment is considerably less expensive than licensed spectrum equipment.

While this looks like a very desirable situation, and would seem to be an ideal alternative to licensed spectrum, there are some significant drawbacks. It is true that multiple signals can coexist in the same spectrum without interfering with each other, but it is also true that as more and more signals coexist, each contributes to the overall basic "noise" in that spectrum. At some point the noise affects current and future receivers, with the result that they become unusable.

This affects the longer length links first. Since the signals are unlicensed, they are also used by other types of systems such as short distance point to multipoint operation.

While CTA in general does not view a spread spectrum interconnection as being the most desirable public safety grade alternative, because there are no regulatory safeguards on the interconnection. On the other hand, they do have their place, and one good place is in rural areas where it is unlikely that there will be a lot of spread spectrum signals around. CTA recommends that SCMIC consider utilizing digital unlicensed microwave radios and PCM digital T1 connectivity to support 2-way radio repeater applications and PSAP operations at least initially in the Near-Term. The proposed links are configured non-protected. We further recommend that SCMIC add redundancy to the non-protected links and/ or consider licensed microwave connectivity in the Mid-Term or Long-Term to improve reliability and performance.

A.4.1.3 Licensed Spectrum in the 4.9 GHz band

In 2003 the Federal Communication Commission (FCC) allocated 50 megahertz (MHz) of spectrum in the 4940-4990 MHz band (4.9 GHz band) for fixed and mobile wireless services and designating the band for use in support of public safety operations.

Public Safety agencies can now utilize inexpensive point-to-point microwave radio equipment capable of transmitting Ethernet and T1 digital data in the in the 4.94 - 4.99 GHz Public Safety frequency band. The radios are licensed by the FCC to protect the end-user from potential interference. The 4.9 wireless applications offer configurable RF channel width and bandwidth allocations that can be custom tailored to fit available spectrum and data transmission requirements. Configurations are easily changed via an Ethernet management GUI to match changing circumstances.

The costs for these products are typically 40 percent less expensive than the traditional microwave links while still maintaining the benefits of FCC license protection.

Applications include:

- Point-to-Point Office WAN, LAN. Wi-Fi. Internet 802.11A connectivity.
- Voice and data connectivity for PSAP and dispatch operations between the Bozeman 9-1-1 center and the Gallatin County EOC.
- Replacement of phone lines to support radio or satellite receiver sites.

A.4.2 Leased Lines

There is a commercial alternative for microwave interconnectivity, and that is leased lines. These are of two types – single dedicated circuit (Plain Old Telephone or POTS), and broadband (T1). These may be carried by wire or cable for short haul circuits, and by fiber or microwave for longer haul circuits. The advantages of leased lines are that there is no infrastructure to own, and they are instantly available. The disadvantages are that the recurring costs may exceed the cost of microwave and the telephone company retains complete control over the circuits – quality and reliability.

CTA recommends that leased lines be considered for very light loaded circuits (single circuit, partial T1), but that wholly owned media be considered for more densely loaded circuits, and for circuits that are critical to the operation of the communications systems.

A.4.3 Fiber Optics

Fiber optics provides the broadband connectivity of licensed microwave, and is completely under the control of the owner. It is relatively inexpensive for short distances – one or several miles, particularly if the owner possesses a physical right-of-way. Installation and right-of-way costs increase with length, and at around 6 to 15 miles it typically makes more sense to install microwave.

One advantage of Fiber is that a single fiber is able to carry more data than a licensed microwave link, and since multiple fibers are typically installed, there is generally excess capacity which can be used for other purposes.

One disadvantage of Fiber is that it is susceptible to damage, either from physical objects and weather for overhead Fiber, or from digging for buried Fiber. The mitigation strategy for damage potential is to have multiple routes to the same location.

A.4.4 UHF Point to Point

There is a portion of the UHF band that is dedicated to point-to-point operation. It operates similar to Microwave, although the bandwidth is considerably less. Generally a UHF link can support two to four voice channels. UHF is licensed, so it is protected. It also is more robust than the higher frequency microwave bands, and can tolerate a certain amount of intervening physical objects such as buildings and trees.

It is typically inexpensive when compared to microwave. UHF frequencies are sometimes difficult to obtain, however.

CTA can see some advantage to continue using UHF Point-to-point where currently available; however we expect that the actual conditions for using UHF links will not prove universal.

A.4.5 Other Media

There are other media in existence, none of which CTA sees as applicable:

- Satellite broadband
- Broadband over power line
- Coaxial cable
- Operator owned wirelines

A.5 MOBILE DATA

Mobile data is increasingly assuming an important role in public safety radio communications. Providing quick access to essential data in the field, mobile data has a number of important advantages including more accurate communications and access to a far broader range of information resources than be easily communicated over a voice interface. Mobile data has applications in both law enforcement and in other public safety entities.

With the tremendous growth in hardware and software technology, the mobile environment and equipment used today may only faintly resemble what will be used tomorrow. This complicates the design process considerably. Aggressive replacement schedules and careful equipment maintenance and management are needed to allow the maximum flexibility throughout the life of the data system and the supporting equipment. Not only will this approach maximize the technology at each phase, but this can allow each county to approach technology upgrades at a pace that suits their budget and needs.

User training is also a vital concern. Some users are less experienced and comfortable with electronic data and may resist converting to electronics. Other users are very familiar with laptops and data systems and will quickly adapt to the newer systems. Training is essential to allow all users to be productive from their initial use.

Mobile data systems also act to reduce voice loading by providing direct access to essential data in the field without requiring dispatcher interface. Without mobile data the officer relays their request to the dispatcher. After assuring that the field request is correctly understood, the dispatcher types the request into another computer(s) and awaits the response.

When the response is received, the dispatcher must retrieve, read and interpret the received data and inform the field officer. Meanwhile the officer in the field is facing an unknown individual(s) and the dispatcher is potentially diverted from other, unrelated calls.

The components of a mobile data system include the following:

Data source – typically this is the local CAD system but can also include other local data bases, regional data and Montana data. The source data does not have to be transmitted over the air. Large and slowly changing data sets, such as geographical data, can be maintained on the vehicular (mobile) computer and accessed through the local hard drive.

Data infrastructure – this is the "back office" element of a mobile data system. Elements in this component include data interconnections with the data sources and the intelligence to convert the data into the radio signals and back. Also included in this element is access management (who is allowed which resources), security controls and back-up capability.

Subscriber equipment – included in this component is the radio interface in the vehicle, the antenna and the laptop computer. The vehicular environment is challenging. Therefore, it is important to assure that rugged equipment, particularly laptops, are selected.

The Gallatin County Sheriff's Office is a participant in the growing State-wide mobile data network.

There are several issues to be considered when using a state-wide mobile data system. First, the coverage area may not provide a sufficiently large footprint within any specific county or city within SCMIC. Our interviews also indicated that the state is continuing to develop sites and working towards increasing the data coverage area.
Next would be evolving equipment needs, considering the evolving nature of data communications equipment and the ever increasing need for information security, hardware and software changes can be expected for the indefinite future. It is recommended that insofar as possible, local budgets allow flexibility to meet these new equipment specifications.

Another shortcoming of a state system is the limited visibility of information currently in the local CAD or records management system (RMS).

This can be a significant limitation where local information is important for the event at hand.

The current system is geared towards law enforcement. Items or data which localities may find valuable (such as fire hydrant locations, local maps, notes on the property or occupants, burning permits, orthophotography, etc.) will not be available under the current state wide mobile data system.

However, in considering all the above, the Montana Mobile Data system is a viable alternative for a county wide mobile data system. The system is being deployed state wide. Officers can also use the data system outside their primary jurisdiction.

The other option is to add a mobile data system which links through the local CAD system to provide access to local records.
Wide area mobile data systems can be deployed over a range of radio frequencies (VHF, UHF, 700 or 800 MHz). The decision point for the selection of the radio band is the bandwidth available, the distribution of the message sizes, and the number of users to be supported. The larger the bandwidth the greater the number of users that can be supported or the larger the individual messages can become. With a sufficiently large bandwidth (usually available in aggregated 700 MHz channels), high resolution photographs or large messages can be supported.

Mobile data systems can also be deployed using devices conforming to the IEEE 802.11 series of standards. These devices operate over unlicensed spectrum and provide a range of options from highly localized access points to a series of access points deployed over a wide area. Using unlicensed spectrum, these devices can be subject to interference. Also, maintaining control over information security is a concern.

Other options for mobile data exist, such as cell telephone based data sharing (CDMA) and satellite technology. However for the SCMIC area, these options are much less desirable either due to coverage issues (cell telephones) or high cost (satellite technology).

Message switch or similar technology will be necessary to format the CAD data into that needed for mobile communications, log individual users and their locations (i.e. which tower they are using), and to manage the over the air interface.

Suitable mobile clients must be available, typically a radio interface (modem), antenna, laptop computer and software interface.

Often overlooked is the significant need for information technology support. Reports need to be generated, forms and options change, new information gathering requirements are made, equipment needs to be maintained and replaced. New data may need to be generated, new users added, former users deleted, and new security threats met.

Counties with active information technology departments may have the resources to support a private mobile data system; however these resources need to be dedicated to mobile data support. A poor support structure has weakened many mobile data implementations.

Where mobile data services multiple agencies, such as fire and law enforcement, care is needed to assure that only authorized data is available to approved personnel. Meeting the needs of a multiple agency deployment requires great care in network design and user authentication.

A.6 REGULATORY ISSUES

Several significant current regulatory or standards-related technology issues will have an impact on planning a land mobile radio (LMR) system. Most of these issues are a direct result of the proliferation of commercial wireless services and rapid growth in all aspects of wireless communications:

- Migration to Digital Technology
- Refarming Narrowbanding of LMR Frequencies below 512 MHz
- The 700-MHz Public Safety Band
- The 800 MHz Rebanding Plan
- Reallocation of the 2-GHz Microwave Bands to Other Services

These issues directly affect the technology that will be available to SCMIC. The following sections outline the efforts of the Federal Communications (FCC) and others to plan and regulate spectrum, and provide some insight into the future direction of technology and policy.

A.6.1 Migration to Digital Technology

Several factors have led the radio communications industry toward digital modulation technology:

- Rapid growth in all areas of wireless communications and the consequent increased demand for radio frequency spectrum;
- The need for improved security;
- The need to transfer more and different kinds of data; and
- Increased computing power available for mobile and portable equipment.

Until recently, conventional radio systems have been almost all based on analog voice modulation, as were the first trunked radio systems. More recently, the leading trunked radio system vendors have offered dual-mode systems capable of supporting either analog or digital communications. Motorola, the largest manufacturer of trunked radio systems, announced several years ago that it would stop shipping new dual-mode radio systems in 2004 in favor of its all-digital product line. Motorola continues to support existing dual-mode systems, including the addition of sites, repeaters, and consoles. Motorola's main largest competitor, M/A-COM, continues to offer dual-mode systems.

A.6.1.1 Digital Communications Techniques

There are two communications techniques commonly used for digital LMR systems. The first is known as frequency-division multiple access (FDMA) in which one user is assigned to one radio frequency (RF) channel. This is historically how radio communications have been performed until recent days. It allows one user per assigned channel to operate at any given time. Most existing LMR systems today are FDMA systems based on a single user transmitting on a 25-kHz channel.

The other commonly used technique is time-division multiple access (TDMA), in which several users share a single channel. Each user is assigned a unique time slot of a single RF channel.

A third technique known as code-division multiple access (CDMA) is commonly used in the commercial wireless industry, but has not been adopted for LMR because of its wide bandwidth requirements.

A.6.1.2 Advantages of Digital Technology

- Increased Capacity

  The main potential advantage of a narrowband digital system over a wideband analog system is increased capacity. The ability to split an existing channel in half effectively doubles the number of users supported in the same bandwidth. Further halving would again double the capacity for a four-fold increase in capacity.

  This advantage would be significant for entities that need to increase their capacity. However, the regulatory flexibility to implement such a channel-splitting scheme is not currently in place, and the systems to provide such abilities are still relatively new.

- Error Correction

  A second advantage to digital technology is in the area of signal recovery. An analog repeater simply retransmits the signal that it receives (and the noise that it receives). A digital repeater performs error correction on the received signal and retransmits it, removing noise and distortion in the process. The signal is cleaned up and retransmitted, and the quality of the retransmitted signal is improved.

  A similar process takes place at the subscriber unit. The subscriber unit performs error correction on the received signal. This allows a digital system to provide better audio quality in weak-signal areas at the fringes of the coverage area.

  The drawback to this is that there is no sense of signal degradation at the fringes and audio simply disappears suddenly at the limits of radio coverage. Conversely, analog voice quality experiences a gradual degradation as the user approaches the fringes of the coverage area and thus provides the user some warning that they may soon be out of range.

- Encryption

  Although analog encryption schemes are still available for conventional radio systems, audio quality is usually poor. Digital encryption is more secure than analog encryption and does not reduce understandability as older methods did.

  Even without encryption, digital LMR systems provide some protection against casual eavesdropping because most scanners on the market are analog. This advantage has been reduced with the advent of scanners capable of decoding digital (unencrypted) radio systems.

- Data Throughput

  A third advantage involves the potential for data transfer over a digital LMR system. Some commercial wireless systems currently send data with instantaneous data rates between 48.6 and 270.836 kbps on a 30-kHz channel, depending on the modulation scheme. Higher data rates such as these may be required to implement the NCIC 2000 mug shot and fingerprint standards. Data rates such as these are not yet available on a typical public safety communication channel. We expect that future data rates, though not matching the rates available from a commercial carrier with dedicated spectrum, will significantly increase.

A.6.1.3 Project 25

The main difficulty with digital technology has been the inability of proprietary solutions from different vendors to communicate directly with each other. This is a major concern for public safety users who have frequent need for interoperability—a need that has been emphasized by the events of September 11, 2001.

The Association of Public-Safety Communications Officials International (APCO), in conjunction with the Telecommunications Industry Association (TIA) and others, initiated Project 25 (P.25) to promote a single non-proprietary standard for digital radio communications in order to improve interoperability between law enforcement agencies and to provide greater competition and cost savings in procurement of radio equipment.

Project 25 includes standards for a common air interface (CAI), so that radio equipment from different vendors' product lines will be able to communicate with each other directly over the air.

The standards, designated ANSI/TIA/EIA-102, are being developed in three phases. Phase I is essentially a frequency-division multiple access (FDMA) technology based on one voice or data channel per 12.5-kHz RF channel. The standards for Phase I are almost complete. When vendors refer to P. 25 compatibility, this is usually what they are referring to.

Phase II, still in the early stages of development, has several goals. One goal is to define technology that will provide one voice channel per 6.25-kHz of spectrum. It will accomplish this by taking a two-pronged approach: an FDMA standard based on a 6.25-kHz RF channels and a TDMA standard based on a four-slot, 25-kHz channel or a two-slot 12.5-kHz channel. The standard requires that any Phase II equipment must be backward-compatible to communicate in P.25 Phase I mode.

Phase II will also define IP-based interconnection standards for infrastructure equipment such as repeaters, controllers and consoles. As it stands now in Phase I, though subscriber equipment from a variety of manufacturers can be mixed, infrastructure equipment, such as repeaters, controllers and consoles, cannot. Once you purchase infrastructure equipment from a single manufacturer, you are locked in to that manufacturer for system upgrades or expansion.
Phase III, also known as Project 25/34, defines the requirements for wideband high-speed data standards. Work on these standards has continued under the auspices of Project MESA, a combined effort of the Project 25 Group and a European standards group. This effort has produced TIA-902, a wideband data standard which the FCC has proposed for use on the wideband interoperability channels in the 700-MHz band.

Momentum behind Project 25 is growing. The FCC has adopted Project 25 Phase I as the standard to be used for the interoperability channels in the new 700-MHz Public Safety band. The federal government has adopted standards based on the Project 25 Phase I efforts as Federal Telecommunications Recommendation 1024B-1998. Major vendors are already producing Project 25 equipment.

Although P.25 is the standard for use on the 700-MHz interoperability channels, the FCC has expressed no intention to adopt P.25 for any other LMR band.

However, other options for conventional digital radio systems are limited, and P.25 may be the best choice for that reason alone.

Keep in mind that the P.25 standard allows vendors to add "enhancements" to the core features of P.25. This could lead to the situation that, even if a vendor's equipment is P.25, there may be features that cannot be accessed by other manufacturers.

A new LMR system design must consider compliance with the Project 25 standard.

A.6.1.4 Cost Differential between Analog and Digital Systems

The initial cost difference between dual-mode analog and digital systems is an important consideration for SCMIC. Digital radio equipment and voters are about ten percent higher than analog. Digital non-fixed subscriber equipment is about 30 to 50 percent higher. The initial costs will need to be weighed against the incremental costs incurred in migrating to digital technology at a later date.

A.6.1.5 Conversion from Analog to Digital

Conversion from analog to digital modulation may seem straightforward, but is more complicated in reality. All non-fixed analog equipment will have to be replaced prior to beginning fully digital operation. This may occur in phases if the existing system can be operated in a dual-mode configuration. Thus, a percentage of repeaters may be replaced with digital repeaters and some of the non-fixed equipment may be replaced and programmed to operate on the digital channels. As funding becomes available, more users and channels may be switched over to the digital system. At a minimum, all analog non-fixed equipment will eventually have to be replaced, along with analog repeaters.

A.6.1.6 Interoperability

Interoperability remains a challenge for several reasons:

- Analog conventional radio systems offer true over-the-air compatibility—unless the systems are in different frequency bands.

- Trunked radio systems from different vendors do not provide over-the-air compatibility with neighboring conventional and trunked systems. In order to provide communications between dissimilar systems, radio vendors must provide patches or other fixes that allow users to talk on an as-needed basis. The alternative is to specify direct over-the-air compatibility with neighboring systems. This typically results in a sole-source negotiated procurement.

- The Project 25 Common Air Interface (CAI) allows subscriber equipment from various vendors to communicate on the same radio system. However, that does not mean that vendors cannot implement additional features that will not be supported by all systems.

- Even trunked radio systems from the same vendor may not be able to communicate with each other. New subscribers may be able to communicate on older systems, but the older subscribers may not work on the new systems. This provides “halfway” compatibility.

- Digital radio systems have an inherent latency – the time it takes to translate an analog voice signal into a digital format and then translate it back to analog voice at the receiver. This latency can be minimized within a single radio system, but when two systems are patched together, the analog-to-digital-to-analog conversion is performed twice rather than once, doubling overall latency and causing greater difficulty for field personnel.

These problems will continue to make interoperability with adjacent jurisdictions using diverse systems and frequency bands a serious technical and operational challenge.

A.6.1.7 Items to Consider When Choosing Analog or Digital Technology

The decision to choose analog or digital modulation consists of several steps:

(1) Determine whether adjacent jurisdictions are implementing digital technology.

(2) Determine whether the procurement will be competitive or negotiated.

(3) Define the current number of system users and the projected growth.

(4) Establish current and future channel requirements based on the number of identified users.

(5) Perform a cost analysis of a dual-mode system with provisions for digital migration compared to a digital system.

(6) Compare the cost and benefits for the lifespan of the system.

All of these steps may not be necessary; for example, if sufficient channels are available and the number of users is not projected to increase, a dual-mode solution may be best for cost reasons alone.

A.6.1.8 Recommendation

Given the current situation in the LMR industry, CTA recommends that SCMIC purchase systems capable of digital operation but not to the exclusion of dual-mode operation.

Non-fixed or subscriber units may be either analog or digital. This takes advantage of the favorable pricing of analog equipment. Public safety agencies or others in need of encryption will require dual-mode units.

Remember, however, that analog and digital units cannot be mixed in a single digital talk group. If one agency uses encryption, even for a small number of units, it may be good for the entire agency to have dual-mode subscriber units.

A.6.1.9 TIA/EIA TSB88

In January 1998, the Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA), a standards-setting body, released Telecommunications Systems Bulletin 88 (TSB88), Wireless Communications Systems - Performance in Noise and Interference-Limited Situations - Recommended Methods for Technology-Independent Modeling, Simulation, and Verification. Although not a true regulatory (FCC-inspired) action, TSB88 (and its latest revisions) is destined to have an impact on the design of two-way radio systems in the foreseeable future.

The document was produced at the request of APCO and the Land Mobile Communications Council (LMCC). Its stated purpose is to "address migration and spectrum management issues involved in the transition to narrowband/bandwidth efficient digital and analog technologies."

Prior to the development of digital technologies, analog radio systems were designed based on a large body of empirical knowledge. System engineers were able to draw upon years of collective experience in the propagation characteristics of analog radio systems, translating acceptable communications to signal level targets. This is not the case with the new digital technologies. Very little information has been published in reference to digital coverage issues, outside of specific vendors' product lines and coverage philosophies.
TSB88 is a beginning step, or basic guideline, for defining and predicting digital/narrowband propagation. It is not a standard, but will achieve "quasi-standard" status in that no other document or statement on the subject exists. Once there is more experience in actual field performance of digital systems, these lessons can be applied to the provisions of TSB88.

As the document itself says, TSB88 is intended to give guidance on the following areas:

- "Establishment of standardized methodology for modeling and simulating narrowband/bandwidth efficient technologies operating in a post 'Refarming' environment;

- "Establishment of a standardized methodology for empirically confirming the performance of narrowband/bandwidth efficient systems operating in a post 'Refarming' environment; and

- "Aggregating the modeling, simulation and empirical performance verification reports into a unified 'Spectrum Management Tool Kit' which may be employed by frequency coordinators, systems engineers and system operators."

TSB88 defines many of the elements of radio system coverage in common terms. There are sections devoted to service area, testing methodology, propagation models, reliability, noise and frequency coordination.

The design of any radio system involves a certain degree of risk. As the vendor's design engineers approach the project, they must account for this risk factor in the overall system plan. A system designed with an overly optimistic propagation model runs the risk of not meeting the coverage requirements of the purchaser. A design that is overly conservative can reduce this risk to negligible levels, but the price of the system may be exorbitant. This act of balancing the risk between insufficient coverage and excessive costs is a major reason SCMIC has retained CTA. In the past there was adequate experience in the area of analog propagation, trunking, simulcast, and multi-site systems to provide for common terminology and references. TSB88-A seeks to provide this commonality of terminology and references for the newer digital and narrowband systems.

TSB88-B, the latest revision of TSB-88 as it stands now, takes a very conservative approach to radio propagation and system design. This will lean toward a design that provides reduced risk for the vendor and possibly higher expense for the customer. However, TSB88-A cannot be ignored. Because of its "quasi-standard" status, the issue of TSB88-A"compliance" will be an issue in any liability or conflict situation.

CTA recommends and will assist SCMIC in designing a radio system with consideration of the provisions of TSB88-B. Designing the system to meet all of the actual and implied recommendations of TSB88-B may lead to over-designing the system and excessive costs. We recommend that TSB88-B be taken into consideration during the design of the system but that the provisions of TSB88-B be applied appropriately to the unique needs of SCMIC.

A.6.2 Refarming (Narrowbanding) of LMR Spectrum below 512 MHz

In an effort to accommodate the increasing need for radio spectrum, the FCC began in 1992 a proceeding to increase spectrum efficiency in the Private LMR (PLMR) bands below 512 MHz. The refarming proceeding, as it became known, introduced major changes to these bands are explained below.

A.6.2.1 New Narrowband Channels

As a first step, the FCC created new narrowband channels in the 150-174 (VHF High), 421-430, 450-470 and 470-512 MHz (UHF) bands.

In the VHF high band, where existing 25-kHz (wideband) channels were spaced at 15 kHz, new narrowband channels were created 7.5 kHz from existing channels. The new channels may only be licensed for bandwidths of 12.5 kHz or less.

In the UHF bands, where existing 25-kHz channels were spaced 25 kHz apart, new channels were created at 12.5 kHz and 6.25 kHz from existing channels. The channels 12.5 kHz from existing channels are available for licensing at 12.5-kHz or less bandwidths and those 6.25 kHz from existing channels are available for licensing at 6.25-kHz or less bandwidths.

The new channels are available for licensing now. However, incumbents are still allowed to operate at the old 25-kHz bandwidths on adjacent channels, creating serious interference to the new channels.

A.6.2.2 Deadlines for Type Acceptance

The refarming proceeding instituted new type acceptance rules, requiring new equipment to meet more efficient standards. The rules required all new equipment to be capable of one voice channel per 12.5 kHz of bandwidth by 1997. This could be accomplished by using either an FDMA solution, transmitting one voice channel in 12.5 kHz of bandwidth, or by TDMA, two voice channels (time slots) in 25 kHz of bandwidth. Either way, the efficiency standard is of one voice channel per 12.5 kHz of bandwidth will be met.

By 1997, all new data transmitting equipment was required to have a data transmission capability of 4800 bps per 6.25 kHz of bandwidth.

By 2005, all new equipment was required to be capable of transmitting at an efficiency of one voice channel per 6.25 kHz. Equipment can operate in 6.25, 12.5 or 25 kHz channels as long as the efficiency standard is met. The 2005 deadline has been stayed indefinitely as the FCC considers the state of the industry and the narrowband migration.

Although new equipment must be capable of operating in more efficient modes, it is still allowed to operate at one voice channel per 25 kHz of bandwidth.

At the time these rules were adopted, the FCC believed that the current congested conditions in the refarming bands would provide a “natural inducement” for users to migrate to narrowband equipment. However, since those rules were enacted, very few incumbents have migrated to the narrower bandwidths, so the FCC has reconsidered its decision that the migration be wholly voluntary.

A.6.2.3 Deadline for Wide-Band Equipment Manufacture

Recently, the FCC decided to set deadlines for migration to greater spectral efficiency. As a result, the FCC decided to prohibit manufacture and importation of equipment capable of operating one voice channel per 25 kHz of bandwidth after January 1, 2011.

A.6.2.4 Deadline for Migration

The FCC also updated the rules to set a fixed deadline for transition to 12.5 kHz operation. The deadline for conversion to 12.5 kHz efficiency is January 1, 2013 for all licensees. After that date, all licensees in the bands 150-512 MHz must operate at one voice channel per 12.5 kHz of bandwidth. Users may continue to use 25 kHz channels as long as the spectral efficiency standard (one voice path per 12.5 kHz) is met.

The FCC has not yet set a deadline for conversion to 6.25 kHz efficiency.

A.6.2.5 Deadline for Wideband Applications

At the same time, the FCC set January 1, 2011 as the deadline for applications for new wideband licenses and modifications to existing wideband licenses. This allows users flexibility to maintain and expand existing systems until two years before the migration deadline.

A.6.2.6 Impact of Refarming on SCMIC’s Communications

With its decision to set deadlines for the transition to 12.5-kHz operation, the FCC has provided much-needed clarity to the refarming issue. SCMIC may legally continue to operate its existing 25-kHz VHF and UHF systems until 2013, but you will eventually face a reduction in bandwidth, which will result in a reduction in coverage. The deadline is far enough in the future to allow time to plan for the transition.

If your existing wideband radio system is sufficient, it may make sense to maintain it as is until the transition date is closer. However, major new investments in equipment should be based on more spectrally efficient technologies.

As the FCC grants more narrowband licenses on adjacent channels, the possibility does exist for some adjacent-channel interference to affect SCMIC's communications. The extent of such interference is difficult to predict. However, the FCC rules still stipulate that when objectionable interference occurs, licensees must cooperate to resolve it.

This has generally been interpreted to mean that the last person on the air is the one responsible for making sure that interference to incumbents is avoided. The frequency coordinator responsible for SCMIC's frequencies also bears responsibility to prevent interference to existing systems.

A.6.2.7 Ultimate Result

Under the rules as they are now, SCMIC can continue to operate its existing system for seven more years. You will not lose existing frequencies, and have minimal risk of being subjected without remedy to harmful interference. If SCMIC should choose to implement a new system on its existing channels utilizing 12.5-kHz bandwidth, it will probably be even further protected.

A.6.3 Trunking in the VHF and UHF Bands

The FCC established rules for trunking in the 150-174 and 450-470 MHz bands. The rules allow trunking as long as concurrence is obtained from affected licensees within 70 miles of the proposed trunked station. The term "affected licensees" refers to stations with assigned frequencies 15 kHz or less from a proposed trunked station with 25-kHz bandwidth, 7.5 kHz or less from a proposed trunked station with 12.5-kHz bandwidth and 3.75 kHz or less from a proposed trunked station with 6.25-kHz bandwidth. In lieu of concurrence, an applicant may provide an engineering study that demonstrates that the proposed station interference contour does not overlap the affected licensee's service territory. Rules for trunking below 512 MHz require so much coordination with neighboring licensees that they make the implementation of trunking systems extremely difficult. This is a complex issue that must be studied more in-depth if SCMIC wishes to pursue trunking in the VHF or UHF band as an option.

A.6.4 The 700-MHz Public Safety Band

A.6.4.1 Balanced Budget Act

The Balanced Budget Act of 1997 mandated that television broadcasting be terminated on channels 60 to 69 (746 to 806 MHz) by December 31, 2006. The Act directed the FCC to allocate 24 MHz of the spectrum from these channels to public safety users. However, provisions were added that would allow incumbent broadcasters to continue broadcasting in this spectrum if any of three factors are true:

(1) A station of one of the four major networks (ABC, CBS, NBC and Fox) is not yet broadcasting a digital television signal in a specific market and has exercised due diligence to meet construction deadlines;

(2) Digital-to-analog signal converters are not readily available in a market; or

(3) More than fifteen percent of the households in a market are not capable of receiving digital television programming by cable or over-the-air (47 U.S.C. 309(j)(14)(B) [Communications Act of 1934, as amended]).

These exceptions may delay significantly the availability of spectrum for public safety users in some areas. Because of the slow pace of the transition, especially in the consumer market, the FCC, in July 2002, mandated that, by January 1, 2007, all new television sets marketed in the United States must be capable of receiving and decoding a DTV signal. This should greatly speed the penetration of DTV, but will still not prevent the delays that are expected. Some in Congress have recognized the need to do more to expedite the transition and free this spectrum for public safety communications, but no significant action has yet been taken.

The remaining 36 MHz of spectrum from the clearing of these television channels will be auctioned for commercial use.

A.6.4.2 Objectives

In response to the Balanced Budget Act of 1997, the FCC established a new public safety land mobile radio band at 764-776/794-806 MHz. The FCC has adopted rules for this spectrum with three basic concerns in mind:

A. Efficiency. The FCC seeks to promote spectrum efficiency in the band by requiring an aggressive standard of one voice channel, or one data channel of 4800 bps, per 6.25 kHz of bandwidth. The FCC has not mandated a specific technology for meeting this requirement, but all systems licensed for this band must use some form of digital modulation. By 2015, all equipment manufactured and marketed for use in the 700-MHz band must meet the 6.25-kHz efficiency mandate, and no new applications for systems operating at 12.5-kHz efficiency will be accepted. By 2017, all systems in the band must operate at 6.25-kHz efficiency.

B. Interoperability. The FCC has set aside a significant portion of the band (2.6 MHz) for interoperability. Although the FCC has refrained from mandating standards for the rest of the band, it has mandated Project 25 Phase I as the standard for use on the narrowband interoperability channels.

C. Flexibility. The FCC has recognized that by mandating the adoption of specific technology standards, it may actually inhibit the acceptance of more advanced and spectrum-efficient technology. Therefore, it has chosen to allow the market to drive the technology.

In that light, it has provided flexibility in the licensing of frequencies in the 700-MHz band. The band is divided into 960 narrowband 6.25-kHz channels and 120 wideband 50-kHz channels.

A licensee may aggregate two or four narrowband channels to create a single 12.5- or 25-kHz channel, as long as the overall spectrum efficiency is one voice channel, or one data channel of 4800 bps, per 6.25 kHz.

A licensee may aggregate two or three wideband channels to create a single 100- or 150-kHz channel with the requirement that the overall spectrum efficiency be at least 384 kbps per 150 kHz.

A.6.4.3 State Licenses

Recognizing the need of states for frequencies across a large geographic area, the FCC offered geographic state licenses for states applying by December 31, 2001. In January 2002, the FCC awarded 53 state licenses (50 states, the District of Columbia, Puerto Rico and the Virgin Islands). The licenses are for 192 narrowband channels. The license grants require that states provide “substantial service” to one-third of their populations by 2012 and to two-thirds by 2017. If a state fails to meet these requirements, its license will be modified to reflect only the areas served by the date indicated. The initial license term will be 15 years. Since there is uncertainty surrounding when incumbent TV broadcasters will be relocated from the band, it seems likely that some extensions to these time limits will be granted by waiver.

A.6.4.4 Regional Planning Committees

The 700-MHz band will be administered by regional planning committees in the same fashion as the 800-MHz NPSPAC band has been. The regions are the same as at 800-MHz with a few exceptions (Michigan and Connecticut).

Regional planning committees are in various stages of forming and preparing plans for approval by the FCC. The only plan approved so far is Region 5, Southern California. Region 24, Missouri, is close, but no other plans have been approved. Until the regional plans have been approved, no licenses will be issued to local public safety users.

A.6.4.5 Time Frame

We expect the 700-MHz band will become widely available in a few years. Delays in the implementation of digital television services will create difficulties and delays for public safety users. In areas without television stations in the 700-MHz band, spectrum will be available much sooner. In these areas, availability depends upon having a regional plan finalized and approved by the FCC. Unfortunately, the delays in availability will probably be the longest in the most populous areas of the country.

To this point, none of the major radio system vendors has produced 700-MHz radio systems, although several have made commitments to do so.

The lack of a viable product line may create further delays for anyone seeking to use the band.

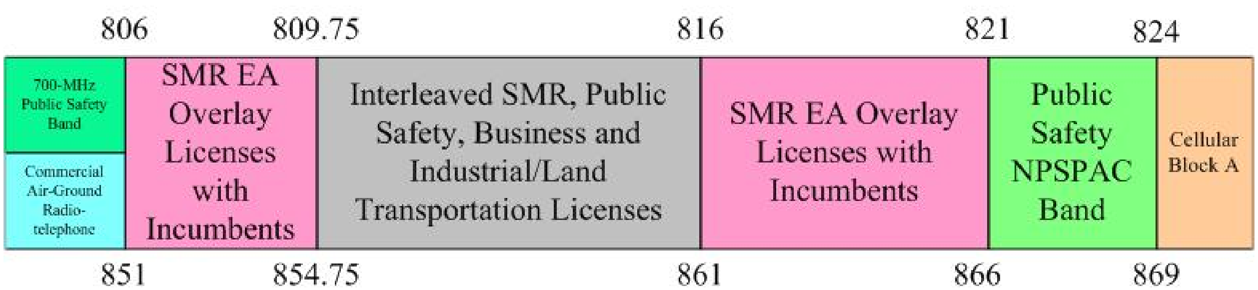
A.6.5 800-MHz Rebanding

On November 21, 2001, in response to documented interference issues in the 800-MHz band, Nextel Communications published a white paper entitled Promoting Public Safety Communications: Realigning the 800-MHz Land Mobile Radio Band to Rectify Commercial Mobile Radio-Public Safety Interference and Allocate Additional Spectrum to Meet Critical Public Safety Needs, proposing a realignment of the 800-MHz band. After extensive debate and comment, the FCC recently adopted a decision to reband the 800-MHz band.

A.6.5.1 The Current Situation

A.6.5.1.1 Existing Frequency Allocations at 800-MHz

The 800-MHz band has evolved over the years to produce the arrangement we have today, as illustrated below. The segments 806-809.75/851-854.75 and 816-821/861-866 MHz are licensed geographically by Economic Areas (EAS) to the Specialized Mobile Radio (SMR) Service. However, there are still many incumbent public safety and other licensees in these bands who were grandfathered when the EA licenses were auctioned.



The segment 809.75-816/854.75-861 MHz is allocated to four categories of users (SMR, Public Safety, Business, and Industrial/Land Transportation), with the different categories interleaved.
The segment 821-824/866-869 MHz, known as the NPSPAC band, is allocated solely to Public Safety.

Above 824 and 869 MHz are the cellular blocks A and B. Below 806 is the new 700-MHz Public Safety band and its remaining incumbent TV stations. The band 849-851 MHz is the Commercial Air-Ground Radiotelephone Service.

A.6.5.1.2 Noise-Limited vs. Interference-Limited Systems

In recent years there have arisen more and more reports of interference to 800-MHz public safety radio systems from Specialized Mobile Radio (SMR), Enhanced SMR (ESMR) and cellular telephone systems (collectively referred to as Commercial Mobile Radio Services [CMRS]) in the 800-MHz bands.

The FCC has requested APCO to compile documentation on instances of this interference. APCO has created Project 39 to address the issue, and submitted an interim report to the FCC on December 24, 2001. That document, available from the APCO website, details the specifics of the interference mechanisms involved. The following is a summary of the causes.

In the early days of the 800-MHz band, SMRs and other radio systems were generally designed to the same parameters: They were designed to cover as much territory with as few sites as possible. This led to systems with sites located at high elevations and operating at high power levels. Coverage for such systems is limited only by the strength of the signal compared to thermal noise of the receiver. Therefore such systems are called "noise-limited" systems.

In order to serve the greatest number of customers as possible, modern cellular and ESMR systems are designed to reuse the limited number of channels available as often as possible. An individual cell is designed to cover a smaller territory, so sites are located at lower elevations with lower powers. Coverage areas of cells tend to overlap and receivers are designed to function in an environment in which interference from adjacent cells is common. These kinds of systems are considered "interference-limited" because their range is limited not by signal-to-noise ratio but by interference from adjacent cells.

When noise-limited and interference-limited systems are operated in close proximity (by frequency and geography) the potential for interference increases, especially to the noise-limited systems such as most public safety users operate. The problem is exacerbated by the high duty-cycles of SMR systems.

A.6.5.1.3 Interference Mechanisms

There are three main categories of interference involved:

A. Intermodulation

Intermodulation is caused by undesired mixing of two or more frequencies. This mixing produces unwanted signals at frequencies that are the combination of sums and differences of the frequencies being mixed.

For example, Transmitter 1 transmits on Frequency F1 and Transmitter 2 transmits at Frequency F2. If these two frequencies mix, they can produce unwanted signals at other frequencies $F3 = 2 \times F1 - F2$ or $F4 = 3 \times F1 - 2 \times F2$, or any other combination of the two frequencies.

Intermodulation can take place in transmitters or receivers or somewhere else and creates unwanted signals that block desired signals. This is especially a problem when the desired signal is weak as in traditional noise-limited systems.

B. Receiver Desensitization

Receiver desensitization (or "desense") is caused when a nearby strong signal overloads the initial amplifier of a receiver, reducing the gain of the amplifier in the radio, thereby inhibiting the ability to receive the desired signal. The effect to the user is the creation of "holes" in radio system coverage. A mobile or portable operating near an SMR site will simply not be able to hear calls from its own system.

C. Transmitter Sideband Noise

Transmitter sideband noise is produced by the modulation of the carrier frequency. Modulation produces frequencies above and below the carrier. The FCC sets limits as to how much energy can be transmitted beyond the limits of a channel, but when a transmitter is nearby, sideband noise can be stronger than the desired weak signal.

All three types of interference were rare, but with the advent of interference-limited systems (the majority of which are owned by Nextel) operating at high duty-cycles near public-safety systems, they are on the increase.

A.6.5.2 Debate and Comments

In response to Nextel's white paper and the filings of other parties, the FCC opened a rule-making proceeding and incorporated the Nextel white paper into the record. In the NPRM, the FCC acknowledged that something must be done to address the interference problem, and requested further comment on a number of issues raised by Nextel's proposal.

In 2002, seventeen organizations, including Nextel, APCO, the American Association of Railroads, the American Mobile Telecommunications Association, the American Petroleum Institute, the Industrial Telecommunications Association, and PCIA, submitted to the FCC a "Consensus Plan" for realigning the 800-MHz band. The Consensus Plan was designed to respond to some of the criticisms to Nextel's white paper. It is the basis of the rebanding plan that the FCC adopted in July 2004.

A.6.5.3 The FCC Rebanding Plan

The text of the FCC's rebanding plan was released August 6 and published in the Federal Register on November 22, 2004. On December 22, the FCC released another Order clarifying issues raised by Rebanding Order. This is a summary of the plan:

(1) All non-Nextel incumbents will be relocated from the 806-809/851-854 MHz General Category band. These licensees will be relocated to former Nextel channels in the 809.75-816/854.75-861 MHz band.

(2) The NPSPAC band will be moved from 821-824/866-869 MHz to the new NPSPAC band at 806-809/851-854 MHz. In most instances, NPSPAC licensees will simply change frequencies by 15 MHz. The FCC has given the 800-MHz regional planning committees (RPCs) the option to modify their frequency plans to optimize packing, but this is a complex issue and the time to plan is short, and therefore most RPCs have chosen to maintain the band structure as it is.

This preserves the structure of the NPSPAC band and the 25-kHz channels spaced 12.5 kHz apart.

(3) Existing Public Safety systems and non-cellular Business, Industrial and Land Transportation (B/ILT) and SMR systems operating on interleaved channels between 809-816/854-861 MHz will continue to operate on those channels.

(4) Nextel will relocate all of its 800-MHz operations to the 817-824/862-869 MHz band, and will vacate all channels it now uses in the 806-817/851-862 MHz band segment. Public safety agencies and later critical infrastructure industries (CII) will have exclusive access to all channels vacated by Nextel in the interleaved portion of the band below 815/860 MHz for a limited number of years.

(5) The FCC has created an Expansion Band at 815-816/860-861 MHz, consisting of B/ILT and SMR channels. Incumbent Public Safety licensees will be given the option to relocate from this band to avoid potential interference from the new ESMR band above 817/862 MHz.

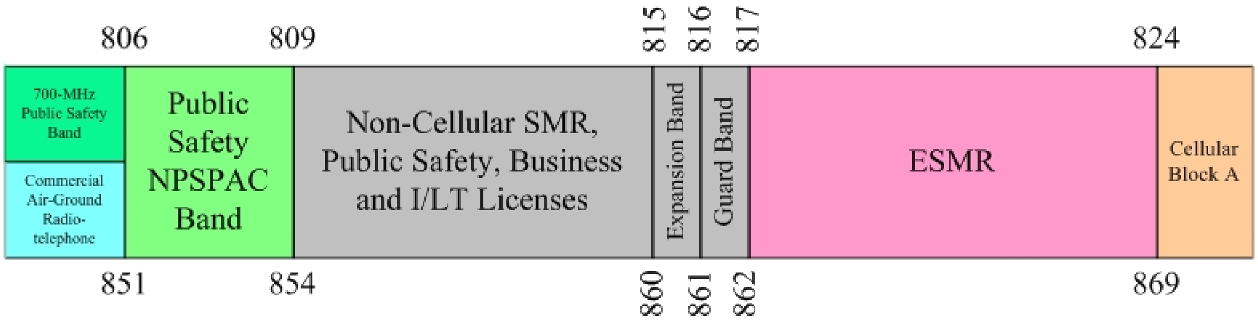
(6) The FCC has also created a Guard Band at 816-817/861-862 MHz. Any 800 MHz licensee may relocate to this spectrum, but will be afforded less protection from interference than licensees in the lower part of the 800-MHz band.

(7) Non-Nextel ESMR operations below 816/861 MHz may stay where they are, but will be subject to a stringent non-interference obligation.

(8) Nextel will receive 10 MHz of spectrum at 1910-1915/1990-1995 MHz.

(9) All costs for all licensees affected by band reconfiguration will be paid up front by Nextel.

Below is an illustration of the 800-MHz band allocations after the transition is completed. In certain parts of the country, most notably border areas and areas served by SouthernLINC, the plan is different.



A.6.5.4 Rebanding Management

In the Rebanding Order, the FCC ordered the five largest stakeholders in the 800-MHz band to select a Transition Administrator (TA) to oversee the process. The selection team chose BearingPoint, a management consulting firm, and its partners, Squire, Sanders & Dempsey L.L.P, and Baseline Telecom Inc.

The TA will oversee the administrative and financial aspects of the band reconfiguration, provide accountability for the reconfiguration process, and help facilitate the band reconfiguration occurring with minimal disruption to licensees, particularly public safety entities. It will also authorize the disbursement of funds for band reconfiguration and resolve funding disputes through mediation.

A.6.5.5 Timetable

The reconfiguration of the 800-MHz band will be performed on the basis of the 55 NPSPAC Public Safety Planning Regions. On January 31, 2005, the TA provided the FCC with a schedule outlining the sequence in which regions will be reconfigured. The schedule is based on four reconfiguration “waves.” Montana is included in Wave 1. Wave 1 is scheduled to begin on June 27, 2005. Each wave begins with the voluntary negotiation period for licensees on Channels 1-120 (806-809 / 851-854 MHz). Voluntary negotiations for NPSPAC licensees in Wave 1 are scheduled to begin seven months later. The waves are staggered by three months, so Wave 2 will begin on October 3, 2005, Wave 3 will begin January 3, 2006, and Wave 4 will begin April 3, 2006.

The schedule is supposed to provide for completion of band reconfiguration within 36 months of the beginning of reconfiguration of the first region. The FCC has mandated that within 18 months, Nextel must have relocated all non-Nextel incumbents in the 806-809 / 851-854 MHz band and begun negotiations with all NPSPAC licensees in the first 20 regions.

The 36 month deadline is extremely aggressive and there are many reasons to believe that the deadline will be extended, especially in border regions where reconfiguration cannot begin until new spectrum-sharing agreements can be reached with Canada and Mexico.

A.6.5.6 Regional Timetable

The FCC will release a public notice 30 days before the official beginning of band reconfiguration for each region. That will initiate a three-month voluntary negotiation period during which Nextel and licensees will seek to come to a retuning agreement, including costs and schedule. If no agreement is reached during that time, there will be a three-month mandatory negotiation period overseen by the TA. If no agreement is reached at that time, the matter will be referred for resolution to the TA and then possibly to the FCC.

A.6.5.7 Application Freeze

During the transition period, when the TA announces the beginning of the transition for a particular NPSPAC region, there will be a temporary freeze on new 800-MHz applications within 70 miles of that region. The freeze will begin 30 days before the voluntary negotiations period and end 30 days after the end of the mandatory negotiations period—a total of approximately eight months.

A.6.5.8 Conclusion

SCMIC entities which obtain any 800 MHz systems must remain aware of the constantly changing environment at 800 MHz.

- Licensees with frequencies in the 806-809/851-854 MHz band will be required to relocate immediately. Most of these have already been relocated or are in negotiations to do so.

- Licensees with frequencies in the 809-816815/854-861 860 MHz band will remain where they are. However, they may have subscribers or base stations programmed for the NPSPAC mutual aid channels, which will require reprogramming or retuning.

- Licensees with frequencies in the 815-816/860-861 MHz band have the option to remain where they are, or move to the 809-815/854-860 MHz band.

- Agencies in the process of submitting applications for 800-MHz frequencies must take the temporary application freeze into consideration when planning a new 800-MHz system. If applications are submitted before the freeze, delays will be minimized. If applications are submitted after the freeze, there may be more spectrum available for licensing.

CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: AMR Ambulance Service

File Name: Gallatin County - AMR Ambulance Interview Record.doc

Date of Interview: 3/29/05

Location of Interview: AMR Ambulance
2101 Industrial Avenue
Bozeman, MT 59715

Persons Interviewed: Kris Kaull, Operations Manager

CTA Interviewer: Mike Dye, David Anderson

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. American Medical Response (AMR) serves the Gallatin valley with medical transport. The service areas we noted are: Bozeman, communities west on I-90 to Three Forks Ambulance District and Clarkston, east to the Park County line, south to Castlerock, and north to the County line. AMR also provides medical support to the Phillip Morris Ranch in Park County.

2. The private company provides about 1800 transports per year and responses to about 3000 calls.

Present Situation

1. AMR is paged out over the Gallatin County paging and shares the Fire North talk channel. They also have a dedicated AMR TAC channel and access to all color mutual aid channels.

2. The 5 ambulances and one supervisor vehicle are all equipped with Motorola Spectra (4) and CDM 1550-LS (2) mobiles. The 20 portable radios, various Kenwood and Motorola models, are 5 – 10 years old.

Present Problems

1. The biggest coverage problem area is on I-90 east through the pass. Other problem areas are remote recreation sites in the Bridger Canyon region, Gallatin Canyon towards Big Sky, and Hyalite Canyon.

Future Requirements

1. Mobile data for 1) access to Emergency Patient Care Records, 2) CAD incident dispatches.

Additional Comments

1. CTA has not received a completed radio survey from this agency.

The draft of this record was sent to Kris Kaull on April 26, 2005.
Corrected draft was returned to CTA Communications on May 4, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Amsterdam Fire Department**
File Name:	**Gallatin County - Amsterdam FD Interview Record DRAFT.doc**
Date of Interview:	**4/6/05**
Location of Interview:	**Amsterdam Fire Department 7192 Churchill Road Amsterdam, MT 59715**
Persons Interviewed:	**Dave Hoekema, Chief Amsterdam Fire**
CTA Interviewer:	**David Anderson**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Amsterdam Fire covers about 90 square miles in the vicinity of Amsterdam and Churchill with a population of about 1800 people. There are 26 volunteers on the roster. AMR out of Bozeman provides medical transport.

2. Amsterdam provides mutual aid primarily to Belgrade, Gallatin Gateway, and Manhatten and serves as first responder in some forest lands on route 84 toward Norris.

3. The growth experienced west of Bozeman is beginning to affect this service area. About 50 new building lots are established.

Present Situation

1. The primary radio channel is Fire North from Bridger Ridge. Other available channels are Fire West, Fire Central, and Fire East. Amsterdam has a single fire TAC channel and has access to the County Fire channel and the State Mutual Aid channels.

2. The department has 10 portables, 5 with officers and 4 in the station. Five trucks have mobiles and 5 more mobiles are in personal cars. The majority of radios are less than 5 years old. The radios generally have capacity for all the needed channels.

Present Problems

1. Users prefer voice pagers over the text models because users sometimes miss information on the second screen. The display is small and hard to read, particularly at night. The pagers are dangerous to read while driving. Pagers need audio and vibration at the same time. The digital pagers are generally regarded as a poor emergency paging tool.

2. Coverage gaps exist along the creek bottoms along Camp Creek Rd, Churchill Rd, and out Norris Rd into Bear Trap Canyon. Coverage problems primarily affect portable talk in but there are some areas of mobile problems.

3. The Fire North repeater is vulnerable to outages. Suggest a backup channel of equal capability.

4. Missed communications from dispatch to the units and visa versa.

Future Requirements

1. Would like to issue a portable radio per person. This requires about 15 additional radios.

2. Would like a printout in the station of the CAD dispatch with incident information and driving directions.

3. Mobile data with CAD dispatch would be nice on 2-3 units used as first response.

4. Plan to add a command vehicle within 5 years which will need a radio.

Additional Comments

1. CTA has received a completed radio survey with comments and maps marking coverage problem areas.

The draft of this record was sent to Dave Hoekema on April 26, 2005.

CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Belgrade Rural Fire District, City of Belgrade Fire, Gallatin County Fire**
File Name:	**Gallatin County Belgrade Fire District Interview Record Draft.DOC**
Date of Interview:	**3/30/05**
Location of Interview:	**Belgrade Fire Department 205 East Main Street Belgrade, MT 59714**
Persons Interviewed:	**Chief Brett Waters Assist Chief. Bryan Connelley (bconnelley@belgradefire.com) Battalion Chief Lonnie Rash**
CTA Interviewer:	**Mike Dye**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. This interview covered three Fire departments; Belgrade Rural Fire District, City of Belgrade Fire, and Gallatin County Fire.

2. The Departments operate in and around the city of Belgrade and north central Gallatin County. The area includes the Bozeman Airport facility.

Present Situation

1. Their current radio units are: 32 mobiles, 127 portables, 6 desk-top units, 1 mobile data terminal, and 90 pagers.

2. The Departments receive their calls via data text pagers, activated by the Bozeman 9-1-1 Center. Radio is normally used for on-scene and added traffic.

Present Problems

1. Coverage is poor in the Bridger canyon area; near Modlow (spelling?), and on the river bottom areas - especially near Highway 84 at the County line adjacent to the Madison River.

2. Various channels have use issues. The most defined is Fire North and the shadow that it produces in and around the base of the Bridger range.

3. They also find limited use areas on the Fire North frequency and some repeater mutual assistance frequencies (Fire West) north of Belgrade in the Dry Creek Canyons.

4. Pager reception is generally good but not all characters appear on the pager in various locations. The limited pager coverage area is again near the base of the Bridger Range.

5. The paging system has no redundancy. They have had several times when the emergency paging system has failed and the dispatch center was not aware of the problem. The system has been down for an unknown time periods. There is no back-up system through dispatch and no back-up ability to notify all Fire Departments.

6. Dispatch Center performance: Generally, we do not have the confidence in the Communications Center to continue to rely on pager/voice updates. The Communications Center is slow to dispatch and acknowledge responding Fire and EMS units. The Communications Center fails to assign specific dispatchers to specific tasks, there by creating a void in unit tracking and ability to follow the incident.

7. Added communications capabilities are needed to provide contact with the Gallatin National Forest dispatch center, Yellowstone National Park, and responding aircraft that use a different PL tone.

8. The Departments are somewhat bothered by receiving "phantom pages" on the paging system.

9. There is a serious concern over the lack of redundancy or a back-up center for the 9-1-1 center.

Future Requirements

1. The Departments will require an additional: 6 mobiles, 67 portables that require upgrading to digital, 3 desk-top units, 34 mobile data terminals, and 50 pagers at the present time.

2. The Departments response areas are growing at a rate of 11% per year so the Departments will grow as well.

3. The Departments would like very much to move to an accurate AVL system with GIS updates done quarterly. Route maps, pre-plans, and contact information should also be available.

Additional Comments

1. An annotated coverage map was provided by the Department which is being used in the coverage studies.

The draft of this record was sent to Chief Brett Waters on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Belgrade Police Department**
File Name:	**Gallatin County Belgrade PD Interview Record DRAFT.doc**
Date of Interview:	**3/30/05**
Location of Interview:	**Belgrade Police 91 East Central Belgrade, MT 59714**
Persons Interviewed:	**Chief Greg Waldon Lt. E.J. Clark**
CTA Interviewer:	**Mike Dye**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Department provides law enforcement services for the City of Belgrade and the surrounding areas.

Present Situation

1. The Department currently has: 10 mobiles, 14 portables, 1 desk-top unit, and 4 mobile data terminals.

2. The Department shares the North repeater with the Gallatin County SO, Manhattan Police, Amsterdam Police, and the Three Forks Marshall.

3. The Department has grown 3 officers in the last 2 years.

Present Problems

1. The Department is experiencing some channel crowding on the North repeater.

2. There are some coverage problems both from the officer-to-dispatch and dispatch-to-officer, particularly in the area near the airport.

3. They cannot send mobile data messages to their printer/fax machines.

Future Requirements

1. The Department will need in the immediate future 2 mobiles, 4 portables, and 5 mobile data units.

2. Other City agencies will need an additional repeater channel. City Public Works is planning to place a repeater on the City Water tower.

The draft of this record was sent to Chief Greg Waldon on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Big Sky Fire Department**
File Name:	**Gallatin County - Big Sky FD Interview Record.doc**
Date of Interview:	**4/1/05**
Location of Interview:	**Blue Moon Bakery**
Persons Interviewed:	**Jason Revisky, Chief Big Sky Fire Department P.O. Box 160382 2735 Aspen Drive Big Sky, MT 59716**
CTA Interviewer:	**David Anderson**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Big Sky Volunteer Fire operates two stations, one in Meadow Village and one up the mountain at the ski area. Big Sky fire provides both fire and EMS transport service. A 3% resort tax exists from which the Fire Department may request funds. There is no obligation for that request to be granted from the resort tax board.

2. Big Sky has provided fire service to Yellowstone club under a service contract since 2000. The Yellowstone Club private fire department is expecting to be operating by mid 2005.

Present Situation

1. The primary radio channel is the North Repeater from Bridger Ridge. Other channels are Fire West, Fire Central, and Fire East are not available in this fire district.

2. The department has about 13 mobile radios mounted in 11 vehicles. Portables are issued to the volunteer personnel. The inventory sheet shows about 25 portable radios in service, about 14 of these are narrowband capable. Fourteen new Motorola XTS 5000 portables have recently been purchased. These are both narrowband capable and upgradeable to P.25 digital and encrypted (as needed).

Present Problems

1. County paging coverage reliability is a problem for volunteers within the service area. Overall paging coverage does not allow volunteers sufficient freedom to move around within the fire district.

2. The copper phone line from Bozeman to the Andesite paging transmitter has reliability problems. Outages occur at the rate of one to two per year. The longest outage was 5 days. The paging distribution system lacks diagnostic capability to detect when a site (or link) is down, so outages are only detected by lack of firemen response.

3. Channel crowding is sometimes a problem on the county fire dispatch channel.

4. Cannot currently talk to the Madison County Sheriff's Office.

Future Requirements

1. Big Sky Fire needs a repeated TAC channel in the area for wild land fires. The department does not feel that portable repeaters would provide enough range to meet this need.

Additional Comments

1. CTA has not received a completed radio survey from this agency.

2. CTA did receive a radio inventory sheet.

The draft of this record was sent to Jason Revisky on April 26, 2005.
Corrected draft was returned to CTA Communications on May 12, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Bozeman Fire Department**
File Name:	**Gallatin County - Bozeman FD Interview Record.doc**
Date of Interview:	**April 4, 2005**
Location of Interview:	**Fire Station 1, Rouse Street**
Persons Interviewed:	**Chuck Winn, Chief** **Gary Clutter, Training Officer** **Jason Shrauger, Deputy DES Director**
CTA Interviewer:	**David Anderson**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. City of Bozeman Fire provides Fire services within the City Limits for the City, approximately 16 square miles and about 35,000 people.

2. The department provides Advanced Life Support EMS non-transport. The department also has a contract with Gallatin County for providing Hazmat and DES services countywide and is one of six regional HM teams for Montana. Under the same contract is Disaster and Emergency Services.

3. The department has 24 suppression firefighters on the roster working a 3-platoon 24 hour shift schedule.

Present Situation

1. In 2005, there will be a total of 1800 – 2000 calls for service. The recent growth rate is about 10% per year. By 2025, the City Manager estimates Bozeman population at about 75,000.

2. There are two fire stations, 34 N. Rouse Street and 410 South 19th Street. There are 24 personnel on the shift rosters, 30 personnel total. The department has 32 portable radios assigned to people and located in trucks. Twelve additional portables are in cache.

3. The dedicated Bozeman Fire dispatch channel is repeated from the Nelson Story Tower in the 1600 block of Garfield. Two non-repeated TAC channels are also used.

4. Fire currently has access to all needed local channels as well as the State Mutual Aid channels. No real need for additional TAC channels. Radios have sufficient programming space.

Present Problems

1. Paging has some coverage problems causing missed pages. The department would like to have two way paging capability.

2. City radio coverage is good. The only issues are some in-building and basement situations.

3. Portable radio talk-in is limited to the Fire North site from the city limits east. Bozeman is the only FD not dispatched on Fire North channel in northern Gallatin County.

4. Dispatch information accuracy and reliability. First call, answer.

Future Requirements

1. Several options were suggested to CTA that could improve paging operations.

    A. Two way paging

    B. The Zetron IP package that allows paging over commercial services to Blackberry devices as well as traditional pagers. Verizon is the predominant cellular data provider for the City of Bozeman Fire Department.

2. Fire would like to have voice radio repeaters on the city water tank with the police repeaters for improved coverage. This site has backup power.

3. Station fire alerting package.

4. Mobile data with: in-vehicle mapping, optimal routing, silent dispatch, and status.

5. Mobile data could also help alleviate overloaded dispatchers. Would also like a dedicated Fire dispatcher. Dispatch is possibly not in standards compliance considering the number of calls handled per operator.

Additional Comments

1. CTA has received a completed radio survey with comments and maps marking coverage problem areas.

2. A copy of the State Mutual Aid Channel list was provided.

Note: The EOC is also the Bozeman Fire Department's responsibility and must fit into the overall BFD recommendations.

The draft of this record was sent to Chuck Winn on April 26, 2005.
Corrected draft was returned to CTA Communications on May 12, 2005.

Bozeman Fire Department
Chuck Winn
Rouse Street
Bozeman, MT 59715

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Bozeman Police Department**

File Name: **Gallatin County - Bozeman PD Interview Record.doc**

Date of Interview: **3/28/05**

Location of Interview: **Law and Justice Building**

Persons Interviewed: **Mark Lachapelle, Deputy Chief Bozeman PD**
Rich McLane, Lieutenant Bozeman PD

CTA Interviewer: **Mike Dye**
David Anderson

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Bozeman PD provides law enforcement services for the City of Bozeman and surrounding areas in Gallatin County.

<u>Present Situation</u>

1. PD operates on one VHF primary dispatch channel. The primary repeater (Motorola Quantar) is located at the blue water tank on Kenyon Drive. Another channel serving as a TAC repeater (Motorola MSR2000) is located on the rooftop of Nelson Story Tower located at Julia Martin Drive on the MSU campus. The effectiveness of the TAC channel is hindered due to RF interference from the MSU Police and facilities repeaters. PD also has access to State Mutual Aid channels, blue, silver, and gold. Mountain Communications is the Motorola service shop. Bridger Radio is the alternate. The City owns property for a possible new site on Mandeville Farm.

2. Shift staffing levels: A maximum of six patrol units; four support services staff; eight detectives, and four administrative staff man a normal day shift. A double shift of (6 units minimum and 12 units maximum) operates daily between 9 AM and 3 AM. The department is considering creating a substation at 34 North Rouse Avenue downtown and is looking at organizing the workforce into geographical beats or service areas (northeast, northwest, southeast, southwest).

3. The department has 40 total vehicles, each equipped with a mobile. Officers are issued their portables. There are about 52 portables in service (Motorola MT1000, HT1000, Visar).

4. The city is participating in the startup of the State mobile data projects. The City has a Motorola DataTac mobile data system running on a dedicated UHF channel. The system is about one year old. The 13 installed laptops are Motorola 800's with VT 650 radio modems. Currently the system runs tags and person queries from CJIN and does limited queries from the RMS system. CAD dispatch and field reporting functions are planned.

5. The County owns and operates a multiple site paging system. Two Zetron 2200 paging terminals are located in dispatch. The Department has 50 pagers most are the Motorola Advisor Gold model. The system is used to page PD and all fire departments. All PD and City fire personnel are required to live within a 20 minute response time.

6. Currently PD has good access to channels for County Fire, Bozeman Fire, Street and Water Department, State Highway Patrol, and MSU Police.

<u>Present Problems</u>

1. The major complaint is portable coverage. Coverage is poor on the west end of town, west of 25th Avenue and northwest area of the city in the area of Valley Center Drive and N. 19th Avenue. Coverage is poor in and around the large retail stores around 19th Ave, W. Durston Road near a Northwest Energy power substation and power lines north of the the Interstate. The Bridger Mountains tend to block some coverage from the North repeater site. The coverage problems are in the talk-in direction from portables to dispatch.

2. Frequent channel crowding occurs especially with support units competing with patrol radio traffic and during the evenings with heavy call volumes.. The City has the FCC license for an additional channel. The City also has real estate for a new site on Mandeville Farm. The main obstacle is engineering the new channel into the system.

3. Radio interference with the Bozeman Fire prevents them from locating their repeater on the Kenyon Drive site and RF interference from MSU Police and Facilities repeaters reduces the effectiveness and coverage of the TAC repeater.

4. Pager coverage is approximately 75% sufficient.

5. Another problem experienced is related to staffing issues in the dispatch center causing “emergency traffic only” advisories when dispatchers are busy with Fire/EMS or EMD calls.

<u>Future Requirements</u>

1. The Department requires reliable portable coverage city-wide and into the County for officer safety.

2. The Mandeville Farm site northeast of 19th Avenue and I-90 could be a possible location for another repeater site.

3. Improved radio site performance, maintenance.

4. Narrowband P25 equipment is needed for all units. Encryption is desired for selected personnel.

5. The department continues to implement a mobile data project and install MDT’s in the marked patrol units. We are utilizing the MDT’s to reduce radio crowding and are integrating call dispatching and officer initiated calls into the system. An additional 20 MDT units wills needed to complete the needed project.

<u>Additional Comments</u>

1. CTA has received a completed radio survey from this agency.

2. We did receive a map showing radio coverage problem areas.

The draft of this record was sent to Deputy Chief Mark Lachapelle on April 26, 2005.
Corrected draft was returned to CTA Communications on June 2, 2005.

Bozeman Police Department
Deputy Chief Mark Lachapelle
Law and Justice Building
16th Street
Bozeman, MT 59715

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: Gallatin County Public Works

File Name: Gallatin County - Bozeman Public Works Interview Record.doc

Date of Interview: 4/08/05

Location of Interview: Bozeman City Shops

Persons Interviewed: John Alston, Superintendent Bozeman Water/Sewer

CTA Interviewer: David Anderson

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Five departments fall under this organization; water, sewer, streets, sanitation, and parks.

2. The main water tanks are located at Kenyon Drive, Sourdough, Goldenstein, and Lymon. The landfill is north of the city on Story Mill Rd.

3. The water department currently uses an Easy Reader automated meter reading system and a SCADA system for tank monitoring.

Present Situation

1. Water and streets use VHF radio. Sanitation and parks use UHF radio.

2. The department's repeaters are located at the Kenyon Drive water tank. Coverage is good.

3. The department currently has field access to City water line locations using tablet computers (not wireless).

Present Problems

1. The public works departments cannot talk directly to the 911 center because the center does not monitor the PW VHF and UHF channels. This creates a worker safety issue for public works and an officer safety issue when public works uses the Bozeman Police channel to access dispatch.

2. The departmental split between the UHF and VHF bands creates an interoperability problem.

3. The water department has had some vandalism to the water supply and needs direct access to Police dispatch and capable communications to mobilize repair resources.

4. Paging coverage and reliability is generally good, with only occasional rogue pages. The paging system also provides automatic pages from the SCADA monitor systems.

Future Requirements

1. The Public Works channels need to be monitored in the 911 dispatch.

2. Wireless field access to city utility information would be nice in the future.

Additional Comments

1. CTA has received a completed radio survey with comments and maps marking coverage problem areas.

The draft of this record was sent to John Alston on April 26, 2005.

Mr. John Alston
Water Department
P.O. Box 1230
Bozeman, MT 59771

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Bridger Canyon Fire Department**
File Name:	**Gallatin County - Bridger Canyon FD Interview Record DRAFT.doc**
Date of Interview:	**April 4, 2005**
Location of Interview:	**Bridger Canyon Fire Station**
Persons Interviewed:	**Dan Astrom, Chief**
CTA Interviewer:	**David Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Bridger Canyon Fire serves the area between the southern entrance of the canyon and about the 28 mile marker on the north end. Assistance extends up Rt. 86 to the Park County line. The area includes Bridger Bowl Ski Hill. AMR provides medical transport.

<u>Present Situation</u>

1. Staffing varies from 18 to 22 volunteers with 18 currently on the roster. The department responds to an average of 75 calls per year.

2. The Law and Justice center receives the calls for service, pages over the County paging system and dispatches over the Fire North channel from the Bridger Ridge site.

3. The department has two vehicles at station 1 (mile marker 8), one vehicle at station 2 (ski area), and a brush truck elsewhere.

4. There is no current shortage of mobile or portable radios. Portables are kept at the station. All radios are programmed with the needed TAC channel, the dispatch channel, mutual aids, and other interoperability channels.

Present Problems

1. There is essentially no radio coverage from the southern canyon entrance (College M) for the first few miles of the canyon. Coverage is also poor at the eastern most extremities of the service area. A handout map and mile marker list was provided detailing the problem areas.

2. Paging is generally reliable with the occasional system maintenance problems and several "ghost" pages per month.

Future Requirements

1. Two to three more mobile radios will be required as the department grows.

2. To ease training and operational issues, all radios should be the same model.

3. Corrected coverage gaps.

4. The department anticipates some growth as Bridger Bowl continues to increase attendance.

Additional Comments

1. CTA has received a completed radio survey with comments and maps marking coverage problem areas.

2. We also received a list of specific areas with coverage problems.

The draft of this record was sent to Dan Astrom on April 26, 2005.

Interviewee Name & Address:
Bridger Canyon Fire Department
Dan Astrom
8081 Bridger Canyon Road
Bozeman, MT 59715

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Clarkston Fire Department**
File Name:	**Gallatin County - Clarkston FD Interview Record.doc**
Date of Interview:	**4/06/05**
Location of Interview:	**Town Pump Gas Station, Three Forks**
Persons Interviewed:	**Tim Lacotta, Chief Clarkston Fire**
CTA Interviewer:	**David Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Clarkston is located 8 miles out a dirt road from Three Forks and includes about 400 square miles of response area. Clarkston FD does not provide medical transport due to high insurance rates. Therefore EMS comes from Three Forks and typically with 45 minute response time. The department does own 2 older ambulances that serve as supply trucks until the transport ambulance gets there.

2. The department is set up for structure and wildland fires with 2 structure trucks, 4 wildlands trucks, and 1 tender.

3. Clarkston FD has 20 volunteers on the roster and about 20 more willing citizens that would respond if needed.

4. Clarkston offers mutual aid primarily to Three Forks, Manhattan, and Willow Creek.

<u>Present Situation</u>

1. The department has 8 portables, one new and rest older, most of which are kept at the station. Some volunteers use their personal radios. Of the 9 mobiles only one is new enough to be narrowband-ready. An older base (crystal type) is located at the station.

2. The primary radio channel is North Repeater (Bridger). Clarkston's impression is that this channel has degraded in performance in recent yeas and consequently, West Repeater (Nixon Ridge) is often a better channel.

Present Problems

1. Both North and West Repeater have coverage problems in the service area, mostly in the low areas. We also heard from the Gallatin Sheriff's Office that Clarkston is a coverage problem. Clarkston FD commonly has to position people for radio relays.

2. County paging is good in the central Clarkston valley, but very unreliable in the bottomlands and surrounding gulches.

Future Requirements

1. The main equipment need is a new base radio and all new mobiles and portables.

2. The top of Pole Gulch was mentioned as good area to locate a new site. Either the Biggs or Lansing property owners would likely offer the real estate. A site in this area would also benefit parts of Three Forks and Manhattan service areas as well as Broadwater County.

Additional Comments

1. CTA has not received a completed radio survey from this agency.

The draft of this record was sent to Tim Lacotta on April 26, 2005.

Clarkston Fire Department
12455 Clarkston Road
Clarkston, MT 59715

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Gallatin County – Fort Ellis Fire Service Area**

File Name: **Gallatin County - Ft Ellis Fire Interview Record.doc**

Date of Interview: **3/30/05**

Location of Interview: **Ft Ellis Fire Station**
3725 Bozeman Trail Rd.
Bozeman, MT 59715

Persons Interviewed: **Chief Fred Cady**

CTA Interviewer: **Mike Dye**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Department operates generally to the immediate east of Bozeman, covering the I-90 route to Livingston. The area is characterized by the canyon path of the highway. 60% of their calls occur in this canyon.

2. The Department expects 10% growth in call volumes in the next 5 year periods.

Present Situation

1. The Department has 18 mobiles, 20 portables, and 1 desk-top radio.

2. The Department does have a transportable repeater that is used quite often.

Present Problems

1. Their primary need and concern is to be able to maintain their current high level of interoperability between agencies using VHF, simplex, analog communications.

2. Along with that they are concerned that any new system will require new multi-mode equipment to be able to communicate with their surrounding agencies. Agencies with limited budgets cannot afford to purchase these radios to the extent that they can live with current technology, analog - VHF.

3. The Department needs portable coverage in their high use areas (I-90 canyon). The Department also needs portable - tactical coverage in these areas. Often the Department cannot communicate from one end of an incident to the other end.

4. The Department feels there is a lack of statewide coordination of radio frequencies and tone-guard frequencies. For example, the newly installed trunked system in Lewis and Clark County has a repeater on the Departments tactical frequency (154.335) which is causing some interference problems. The Fire Council also had a problem when installing Fire North repeater when it chose a tone-guard frequency the same as the Sheriff's repeater in Powell County.

5. The paging system leaves a lot to be desired. The Department would like for the pager/dispatch system to be re-thought with the goal on moving to a voice/data system.

6. The Department would like to continue the use of a dedicated, licensed tactical frequency. This is used for tactical, training, and administrative purposes.

7. The Department needs for dispatch to give better call type, location, and situation information. They are frequently dispatched to bad locations on the interstate. While dispatchers clearly receive bad information there should be some procedures similar to the EMD procedures that could be implemented to get better information from the reporting parties.

8. The Department needs communications ability with the Montana Rail Link.

Future Requirements

1. The Department will require an additional 5 mobiles, 10 portables, and 5 pagers.

2. The Department would like to suggest that consideration be given to locating the Fire East tactical repeater on Peak6458'/1968m above I-90, west of Chestnut.

Additional Comments

1. While useful for administrative and record keeping purposes, the data only paging system is clearly not as effective for emergency paging as tone/voice paging would be. Although they do not have a research quote, it is clear that people learn through various modes, i.e. visual-auditory-learning by doing, etc. In the context of emergency alerting and from personnel and others observations; HEARING the alerting page "sticks" better than seeing it. The Department would like to see if there has been research done in this area and if combining technology (voice and data) would give them the best of both worlds.

2. For the improvement process that is currently going on, the Department would like to make sure that if the process stops or is stopped, that what they have added does not keep the remainder from working.

3. An annotated coverage map was provided by the Department which is being used in the coverage studies.

The draft of this record was sent to Chief Fred Cady on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Gallatin County 9-1-1**
File Name:	**Gallatin County - Gallatin County 9-1-1 Interview Record.doc**
Date of Interview:	**3/28/05**
Location of Interview:	**Law & Justice Building 615 South 16th Street Bozeman, MT 59715**
Persons Interviewed:	**Ben Hess**
CTA Interviewer:	**Mike Dye**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The agency provides 9-1-1 and dispatch service for Gallatin County and all cities. The Southeast corners of Broadwater and Jefferson Counties. The Big Sky and Yellowstone Club areas of Madison County that is only accessible from Montana Highway 64. South to the County's border with Yellowstone National Park.

2. The agency's statistics for a 2 month period of January - February (2005) are:
   9-1-1 calls - 5,992
   7 digit number calls - 39,702

   Statistics for the 2004 Calendar year are:
   Police dispatches - 63,930
   Fire dispatches - 3,931
   Medical dispatches - 3,001

3. The agency also provides Warrant confirmation, CJIN entry, and Emergency Medical Dispatching services for the area.

Present Situation

1. The Center has 4 operator/dispatcher positions with 3 to 5 personnel on duty normally.

2. The agency uses an Orbacom, TDM - 150, LED consoles.

3. The Center has Sentinel 5.0/Rescue Star telephones. The 9-1-1 switch provider is CML. There are 6 9-1-1 trunks with 11 other telephone circuits. Telephone service is provided by QWEST and 3 Rivers Telephone Service.

4. They have a 4 year old Intergraph Public Safety CAD, running version 7.7.6, with a redundant processor; and 9-1-1, RMS, CJIN, and mobile data interfaces.

5. There is a Motorola RNC controller for the mobile data system.

6. There is a Stancil recorder that is 3.5 years old.

7. For paging, the agency uses a Zetron 2200 paging system. There are 457 pagers on the system. The paging sites are: High Flats, Andesite Mountain, West Yellowstone, Bridger Ridge, Round Springs, and Horse Butte. The system is connected via microwave from the Center to High Flat. The system has redundant model 2200 paging terminals located at the 911 center and has several methods of paging entry. Generally Motorola Advisor Gold alphanumeric pagers are used by law, fire, and EMS throughout the County.

Present Problems

1. A major issue is that Sheriff's Deputies cannot use portables throughout the County and especially inside the Law & Justice Building.

2. There have been some paging issues in the Willow Creek and Manhattan areas with the paging antenna possibly being oriented in the wrong direction.

3. The Centers only access to the Andesite Mountain and Horse Butte sites is through a long above ground run of telephone lines.

4. Sometime agencies using the North repeater and the North simplex channels are interfering with each other canceling out their traffic.

5. The grounding and surge protection in the Center does not meet R-56 or other standards.

6. The Department is concerned about site and infrastructure integrity. The key Gallatin County tower sites generally operate reliably, however there has been no County oversight for infrastructure for some time. There are some reports of degraded radio coverage, some unresolved intermediation problems, and there are some reports of sites in poor condition with poor grounding. These factors add up to a concern that the infrastructure is overdue for a careful review and refurbishment.

Future Requirements

1. The Centers facilities will have to grow as the community and calls for service increase. At present there seems no easy way to gain space.

2. The grounding and surge protection in the Center needs to be improved.

Additional Comments

1. An increase in the mobile data system would be beneficial.

The draft of this record was sent to Ben Hess on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Gallatin County – Gallatin River Ranch Fire**

File Name: **Gallatin County - Gallatin River Ranch Interview Record.doc**

Date of Interview: **3/31/05**

Location of Interview: **Gallatin River Ranch Fire Department**
480 Equestrian Center 100P
P.O. Box 109
Manhattan, MT 59741

Persons Interviewed: **Chief Joe Vasarella**

CTA Interviewer: **Mike Dye**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The organization provides Fire, security, and other services for the Gallatin River Ranch.

<u>Present Situation</u>

1. The Department currently has: 5 mobiles, 11 portables, 2 desk-top units, no mobile data units, and 25 pagers.

2. The Department receives calls from the Bozeman center and internally from citizens of the ranch.

3. The Department does not have mutual aid within the ranch because a loaded fire engine cannot cross the bridge across the Gallatin River. This is due to weight restrictions.

4. The desk-top radios are located at the Fire Department and at the Service Center.

Present Problems

1. There are several areas of poor reception and dead spots within the ranch.

2. Reception of other Fire Departments is often scratchy and unable to read.

3. The Department is also bothered by "ghost pages" on the paging system.

Future Requirements

1. The Department expects to grow to requiring; 1 additional mobile; and 5 added portables.

2. The Department would like to explore the use of mobile data terminals with 2 units.

Additional Comments

1. The ranch management may be in favor of allowing a transmitter site of the ranch property.

The draft of this record was sent to Chief Joe Vasarella on April 26, 2005.
Corrected draft was returned to CTA Communications on May 16, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – HAM Volunteers and Search & Rescue**
File Name:	**Gallatin County - HAM-SAR-Posse Interview Record.doc**
Date of Interview:	**3/30/05**
Location of Interview:	**Gallatin County EOC** **C/O Don Wilson** **418 S Black Ave** **Bozeman, MT. 59715**
Persons Interviewed:	**Don Wilson**
CTA Interviewer:	**Mike Dye**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. This interview covered a large, multi-tasked group. The group divisions are:

   Gallatin County Sheriff's Office Coordinators - provide over all coordination, these are being handled by the GCSO.

   Gallatin County Search and Rescue - consists of 11 sub groups that perform search and rescue operations.

   Posse (POSSE) - generalized search group, responds to all operations.

   Back County Hasty Team (HASTY) - search teams.

   Alpine Rescue (ALPINE) - specializes in high angle, rockwork, ice work, etc.

Gallatin Valley Snowmobile Association (GVSA) - utilize snowmobiles and 4 wheelers in search operations.

Civil Air Patrol (CAP) - fly for searches.

Central Helicopter - commercial unit that provides short hauls and spotting services.

Salvation Army - provides canteen services.

Gallatin HAM Radio Club (GHRC) - Create and enhance communications where needed, provide HF equipment and propagation using NVIS propagation, also provide a VHF radio net.

Big Sky Search & Rescue (BSSR) - self-contained search and rescue located in Big Sky.

West Yellowstone Search & Rescue (WYSAR) - self-contained search and rescue located in West Yellowstone.

Dogs (DOGS) - Provide dog searches in all areas; hope to expand the number of teams in the near future.

Divers (DIVERS) - specialist group with advanced SCUBA training, work in lakes and some rivers for recovery and searches.

2. The overall group works generally in the Gallatin County, but routinely work at other locations as requested.

Present Situation

1. The current radio equipment for the groups is as follows:

	MOBILES	PORTABLES	DESK-TOPS	MDC	PAGERS
Posse	6	20	1	0	20
Hasty	0	9	0	0	36
Alpine	0	0	0	0	0
GVSA	2	2	0	0	0
CAP	0	0	0	0	3
GHRC	0	0	0	0	7

	MOBILES	PORTABLES	DESK-TOPS	MDC	PAGERS
BSSR	0	0	0	0	0
WYSAR	0	0	1	0	2
DOGS	0	2	0	0	5
DIVERS	0	0	0	0	5

2. The operations are toned out from the Gallatin County 9-1-1 when needed.

3. The units have mutual aid frequencies that seem to work well; the Purple channel is designated for Search & Rescue in state and Violet is national.

4. The GHRC has repeaters at the following locations:

   High Flats
   Bridger Ridge
   Round Springs
   Bozeman Pass
   Buck Ridge

Present Problems

1. Coverage is spotty in the following areas:

   North of Bridger
   East of Bridger
   Canyon areas between Bozeman and West Yellowstone
   South Plateau areas
   Lionshead area
   Cabin Creek area

2. There is no or little coverage west of West Yellowstone.

3. There are problems with interaction of West Yellowstone agencies with Idaho and helicopters coming in from Idaho Falls.

4. The requirement of swapping repeaters at certain points North Repeater and South Repeater causes operational problems. This is causing heterodyne problems near Mile 35 in the Canyon.

5. The Search and Rescue repeaters are on the same PL and interfere with each other.

6. WYSAR has coverage and contact problems with Fremont County Search and Rescue.

Future Requirements

1. There is a near term need for the additional radio equipment:

	MOBILES	PORTABLES	DESK-TOPS	MDC	PAGERS
Posse	5	36	0	0	36
Hasty	0	0	0	0	0
Alpine	0	0	0	0	0
GVSA	0	20	0	0	15
CAP	0	0	0	0	1
GHRC	0	0	0	0	0
BSSR	0	0	0	0	0
WYSAR	1	6	0	0	6
DOGS	0	0	0	0	0
DIVERS	0	5	0	0	0

2. Rework the portable repeaters to operate on differing PL's and tones. Obtain and added frequency for this.

3. Automated location programs that would track searchers locations. This will need to be conveniently portable and translated into a mapping program.

Additional Comments

1. Multiple coverage problem maps were provided that are being retained for coverage study purposes.

The draft of this record was sent to Don Wilson on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Health Department & Bozeman Deaconess Hospital**
File Name:	**Gallatin County - Health Department-Deaconess Hospital Interview Record.doc**
Date of Interview:	**3/29/05**
Location of Interview:	**Gallatin County Health Department 311 W. Main Street, Room 108 Bozeman, MT 59715**
Persons Interviewed:	**Stephanie Nelson - Health Department Kathryn Naas - Bozeman Deaconess (Survey Form submitted by Betty Katakan {spelling} - Emergency Preparedness Coordinator)**
CTA Interviewer:	**Mike Dye, Dave Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Health Department provides services for the entire County, including Cities. The services generally are in the areas of Environmental Health, Human Services (immunizations, etc.), and Infection Control services. In this activity, the three main objectives are:

   Surveillance
   Containment
   Prevention

2. Bozeman Deaconess Hospital is the primary medical care facility in the area. It is the trauma unit for the near region, with the closest next trauma unit being St. James in Butte.

3. Ancillary medical facilities in the area are the Gallatin Community Clinic and the Student Health Center at Montana State University.

4. There are approximately 100 health care providers in the community.

Present Situation

1. The Health Department does not currently use communications equipment on the public safety systems.

2. The Hospital uses an internal paging system and a hospital radio system for maintenance and security. They have 1 desk-top unit that accesses the public safety system.

3. Public contact is via normal telephone circuits.

4. The Health Department does have a desk position in the EOC.

5. The Health Department keeps 3 personnel on duty/call at all times.

Present Problems

1. In a public health crisis the Departments telephones are overwhelmed by the number of calls.

2. The Hospital does not have contact with aviation response units.

3. Neither agency has two way radio communications with the public safety responders other than through the auspices of the HAM group volunteers.

Future Requirements

1. To equip the Health Department with radios would require: 2 mobiles, 10 portables, 3 desk-top units, 2 mobile data units, and 43 pagers.

2. The Health Department would benefit being on the County paging system. This would require 43 pagers at present and would probably grow by 13 additional pagers.

3. The Emergency Room would benefit by having radio contact with public safety units. The Hospital will need 10 portables and 1 additional desk-top unit.

4. The Hospital desires radio ability throughout the hospital facility as well as in the County.

Additional Comments

1. The area served was 75,000 in 2004; by 2010 this number should be at 85,000; and 93,000 by 2015.

2. Bozeman Deaconess is concerned about user education issues for the radio system.

The draft of this record was sent to Stephanie Nelson on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Gallatin County – Manhattan Police Department**

File Name: **Gallatin County - Manhattan PD Interview Record Draft.doc**

Date of Interview: **3/31/05**

Location of Interview: **Manhattan Police Department**
P.O. Box 1162
Manhattan, MT 59741

Persons Interviewed: **Dave Rewitz**

CTA Interviewer: **Mike Dye**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Provides law enforcement services in the city of Manhattan and surrounding areas. Officers rotate on-call duty during the early morning hours.

<u>Present Situation</u>

1. The Department has 3 mobiles, 3 portables, and 3 pagers. Approximately half of the radios are older models and may require replacement.

2. The Department is a non-terminal agency and uses a web site to run inquiries for vehicle registrations and driver histories. All entries for the Department are made through Bozeman dispatch.

3. The City is experiencing tremendous growth and is expecting this trend to continue. Based on statistics and plans the City will grow 159% by 2010.

4. The majority of the Departments calls come through direct calls and pages from the citizens or are officer generated calls. Only 8% of the Departments call load comes from the Bozeman dispatch center.

Present Problems

1. Mobile radio coverage is sufficient but portable coverage is sporadic. Some problems occur when using the North repeater site. Coverage is poor in the Logan area.

2. The pagers have some problems with data loss and they are receiving "ghost pages".

3. The Department is experiencing problems with channel crowding; Gallatin SO, Belgrade PD, Amsterdam PD, and Three Forks Marshall all share the North repeater with the Department.

4. The dispatchers are often too busy and the Department often has trouble with the availability of dispatchers for response. This sometimes causes a delay in dispatcher response. To a certain degree officers have begun to not rely on the dispatchers.

5. There seems also to be a keying, timing problem that is cutting off the first syllables; this causes repeat traffic, etc., to determine which officer is being addressed.

Future Requirements

1. The Department immediately requires a fourth radio set of mobile, portable, pager, and mobile data terminal.

2. The Department needs immediately a desk-top radio in the Town offices.

Additional Comments

1. The channel crowding and apparent insufficient dispatch staff is causing great concern in the Department. The Department would like the northern area radio set-up to be re-thought with the possibility of adding channels and dispatchers.

The draft of this record was sent to Dave Rewitz on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Mountain Communications Radio Shop**

File Name: **Gallatin County - Mountain Comm Shop Interview Record.doc**

Date of Interview: **4/06/05**

Location of Interview: **605 North Wallace #2,**
Bozeman, MT 59772

Persons Interviewed: **Alan Harper, Communications Consultant**
Charley Gilmore, Technician

CTA Interviewer: **David Anderson**

The following points were conveyed to CTA during this interview:

General Discussion Notes

1. Two CTA staff had discussions with Mountain Communications to learn about the radio infrastructure and understand maintenance considerations for the region.

2. We used this session to locate all the tower sites in the 5 County regions on the maps and discussed the general condition and limitations at these sites. The shop personnel were an open and helpful resource in helping us understand the existing equipment.

3. We discussed from a technical viewpoint, some of the issues with the Gallatin County paging system as well as potential solutions.

The draft of this record was sent to Alan Harper on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Montana State University Police Department**

File Name: **Gallatin County - MSU PD Interview Record.doc**

Date of Interview: **4/04/05**

Location of Interview: **Huffman Building**

Persons Interviewed: **Robert Putzke, Chief**
Donna LaRue, Assistant Chief

CTA Interviewer: **David Anderson**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Montana State University (MSU) Police provides all law enforcement on the MSU campus. MSU currently has 2500 faculty and staff and about 12,000 students.

2. Responsibilities include traditional law enforcement as well as emergency preparedness for threats of domestic violence. MSU conducts agricultural research, a potential target.

3. The department frequently receives transferred calls from Bozeman 911, and rarely sends calls the other way.

Present Situation

1. MSU PD responded to 200 incidents in 2004. The department is currently at 13 officers with authorized strength at 17 officers. The department also has 4 students that serve on as building security assistants.

2. The force operates a campus “911” center at the Huffman building. On campus calls to x2121 arrive at a single dispatch position. The dispatch center operates 24/7 and has one operator position. Eight dispatchers are on the roster, and work 10 hour shifts with overlap from 9 PM to 3 AM. Calls are dispatched on a dedicated MSU police channel (business license) that is repeated from the top of “South Hedges” dorm at the corner of 12th and Grant streets. The department has two TAC simplex channels, one of which is the same frequency as the main dispatch frequency.

3. The department has 3 marked vehicles, 2 unmarked (without radio) and 3 parking violation vehicles, and one department vehicle. The fleet has a total of 6 mobile radios, all of which are fairly old.

4. Radio coverage is described as generally good with a few weak spots behind some buildings. Radio coverage is a problem in the campus steam tunnels.

Present Problems

1. Repeater reliability. The main repeater has been down for as long as one week. The department would like a backup repeater with backup power to be located at the Huffman building.

2. Coverage in the steam tunnels.

Future Requirements

1. The department is investigating mobile data. Currently CJIN queries are typed two times; into the display log, and into the CJIN terminal. Two mobile data needs are identified:

   A. State and national queries: Vehicle tags, persons.

   B. Access to GIS and facility information: Building plans, fire alarms, security points, environmental alarms, and HAZMAT handbooks.

2. New radios should have capacity for at least 32 – 64 channels to allow needed access to other agencies and departments.

3. Five year growth plans include radios for the addition of 2 cars and 4 personnel.

4. Because of the volume of calls transferred from 911, a CAD workstation at MSU would facilitate rapid and accurate handling of the transfer.

Additional Comments

1. CTA did not receive a completed radio survey. However, we did receive a completed Dispatch Center Observation Record.

The draft of this record was sent to Robert Putzke on April 26, 2005.

Montana State University Police Department
116 Roy E. Huffman Building
Bozeman, MT 59717

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Rae & Sourdough Fire Departments**

File Name: **Gallatin County - Rae & Sourdough FD Interview Record.doc**

Date of Interview: **4/07/05**

Location of Interview: **Bozeman, MT**

Persons Interviewed: **Brian Crandell**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Rae and Sourdough Fire Departments are legally two separate fire districts. Between the two districts, there are three stations. While personnel technically belong to one or the other department, operations are integrated with one fire chief and one command structure.

2. The Gallatin County Fire Council consists of all of the fire departments in Gallatin County.

Present Situation

1. Gallatin County and the user agencies jointly maintain a digital paging system that is used for alerting.

2. All departments are dispatched by the Bozeman/Gallatin County 911 Center. Bozeman City Fire is dispatched on one channel. The remaining departments use the "Fire North Channel to communicate with dispatch. The County Fire Council maintains two operational tactical repeaters.

3. All of the local, state, and federal public safety agencies operate on VHF High-band. This permits a high degree of interoperability.

Present Problems

1. Pager system is poor and inconsistent especially inside of metal clad buildings. Alerting system performance varies greatly between locations within the Gallatin County area (notably, Big Sky and Gallatin Canyon [where it has never worked well], west end of the valley, Willow Creek, Three Forks). It seems like the CAD does not talk efficiently to the paging system, slowing page process time. The alerting system will go out of service with the 911 center staff having no idea that failure is ongoing, until they attempt to alert a responder and get no response (because the alerting system has failed). The 911 Center staff does not make a voice announcement on the Fire North dispatch channel once the alert page is sent.

2. Poor voice coverage on Fire North Repeater east of South 19th to the top of Sourdough Ridge, from the Gallatin National Forest (south) to the Southern limits of the City of Bozeman, and north of Huffine Lane (east of Cottonwood Road) . Poor performance on Ruby repeater west of Cobb Hill Road on Huffine Lane and Four Corners area.

3. The operational area tactical repeaters operated by the Gallatin County Fire Council work well and have reliable coverage for the areas they serve. There are areas of that are not served by an operational area repeater. Those areas are Black's Ford, The Norris Road area west of the Churchill Road intersection, the Gateway Area south of 4 Corners (then east and west), the entire Fort Ellis area, Jackson Creek area, Clarkston and Dry Creek areas, Springhill area, and Willow Creek Area. I do not know why the coverage is not reliable. It could be the absence of a reliable repeater or the lack of a properly sited repeater.

4. There has been and continues to be a wide variance in the quality of 911 services delivered to our residents and our responders. The difference between the performance of the most capable dispatcher (very good, responsive, attentive, helpful, capable, reliable, nice, engaged, others) and the least capable dispatcher performance (911 calls received but not dispatched properly, not answering radio calls from responders, wrong dispatch procedures followed, unresponsive, not helpful, incompetent, unreliable, not considerate, others) is extraordinary.

5. There has been a lack of demonstrated ability of the 911 system to detect, correct, recover from, feedback or learn from problems that are within the span of control and sphere of influence of the 911 system. Brian feels that he has no evidence that the 911 system knows when it is experiencing or has experienced a non-standard performance. If a radio system is inoperative, he does not have confidence that the 911 system will know about the failure. If an event is dispatched in a slow or inaccurate manner, he does not have confidence that the 911 system has a standard way to learn from their experience and improve their service delivery. He is concerned that the 911 system does not have a service performance benchmark system; that the 911 system does not know if its current performance is in compliance with the service performance benchmark, and the 911 system has not demonstrated that it can, as a system, learn from its experience and use those lessons learned to improve its service delivery performance.

6. The structure of the administrative board does not give the outlying fire departments a voice in the governance of the system.

Future Requirements

1. **Communications System Infrastructure -** the present and future 911 communications system capability needs the support of a robust reliable infrastructure or backbone. We need reliable, robust, redundant communications sites and system connecting the sites (ex. Microwave). The infra-structure system should be located in places where they serve Gallatin County with consistent 911 communications including the Three Forks and Willow Creek areas, Big Sky, Rocky Creek Canyon, Clarkston, and West Yellowstone.

2. **Mobile Data**: There is a need for a mobile data system that is integrated with status reporting, mapping, CAD, etc.

3. **Alerting**: Given the needs for integrated response to escalating events, the ability to connect command staff from various responding entities and areas within in SCMIC, we need a public safety designed, owned, maintained, operated, and funded full duplex mobile telephone network with full internet connectivity for our FD area, our Operational Area, and for the SCMIC area. This would include the next generation of alerting, messaging, internet access (similar to the Blackberry capability).

Push to talk radio is far more valuable to field responders communicating among themselves and themselves and command. Command officers currently rely heavily on the use of cellular phones to support the command functions. History across the country clearly illustrates that, during a significant incident, commercial cellular phone systems (and their commercial equivalents) will become over loaded and not allow critical responder phone calls to be completed. A publicly owned and operated cellular type phone system would allow the class of use to be determined by the 911 system thus maintaining this critical communications capability when the system is challenged by extraordinary demand.

Additional Comments

None.

The draft of this record was sent to Brian Crandell on May 11, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Gallatin County – Roads and Bridges**

File Name: **Gallatin County - Roads & Bridges Interview Record.doc**

Date of Interview: **3/29/05**

Location of Interview: **Gallatin County Roads & Bridges**
201 W. Tamarack
Bozeman, MT 59715

Persons Interviewed: **Dave Fowler**

CTA Interviewer: **Mike Dye**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Provide road and bridge maintenance and service within Gallatin County. The agency also maintains culverts, etc. and provides a junk car service for the County.

Present Situation

1. The agency currently has: 55 mobiles, 4 portables, 6 desk-tops. (An inventory list was presented that is being retained for traffic loading and cost estimation.)

2. The agency operates off of one channel, WPVU655, with RX 151.340 and TX 159.240, and PL code 131.8. This transmitter is located on the Nixon Ridge site. (A copy of the license was presented and is being used for propagation studies.)

3. The agency uses 1 pager on the County pager system. The "on-call" duty is rotated among the supervisors.

4. The portables are used by supervisors and have access to the Purple, Brown, and Gold channels as well as the Sheriff's Office.

Present Problems

1. The agency has some interference problems with Sweet Grass County operations.

2. Some mobiles are older models (see inventory list) and will need replacement prior to narrow-banding.

Future Requirements

1. The agency will need an additional 6 mobiles in the near future.

2. The agency expects to grow with the County.

Additional Comments

None.

The draft of this record was sent to Dave Fowler on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Sheriff's Office**
File Name:	**Gallatin County - Sheriff's Office Interview Record.doc**
Date of Interview:	**3/28/05**
Location of Interview:	**Law & Justice Building** **615 South 16th Street** **Bozeman, MT 59715**
Persons Interviewed:	**Sgt. Jason Jarrett** **Jason Shrauger**
CTA Interviewer:	**Mike Dye, Dave Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Provide law enforcement services and functions for Gallatin County.

2. Provides Search and Rescue service for the County and near region.

<u>Present Situation</u>

1. The Department has a current radio fleet of: 52 mobiles; 50 portables; 1 desk-top unit; and 8 mobile data terminals.

2. All portables, repeaters and approximately 2/3s of the mobiles are narrow-band capable.

3. The Department has 3 portable "suitcase" repeaters available for use. They are generally assigned to the SWAT team, Search and Rescue, and the Ruby fire mutual aid channel.

4. The Department operates from 3 channels; the North repeater; the South repeater; and SO Tactical.

5. For mutual aid the Department uses the state Blue, Silver, and Gold channels; Search and Rescue uses the Purple mutual aid channel.

6. All paging is done from the County owned paging system from the High Flats, Timberline, Andesite Mountain, and Round Springs sites. The pagers are alpha/numeric.

7. The Department is currently using 8 mobile data terminals; these are operated with the State system on 2 County provided sites.

Present Problems

1. The major problem is radio propagation. The Department operates in an extremely large area.

2. The Department has concerns about their radio system's reliability - especially at the site locations, the system's redundancy, physical security, and radio interference security.

3. The Department does not have portable coverage County-wide, and in-building coverage is light.

4. The paging system has propagation problems, using High Flats-Timberline-and recently Round Springs; The Andesite Mountain paging site is only accessed by a telephone line that runs above ground for miles through the river canyon.

Future Requirements

1. The Department requires portable coverage Countywide for Officer safety.

2. The Department feels they are 99% interoperable with local and surrounding agencies by using the simplex color named channels. The desire is that nothing proposed in this report or following actions reduces this interoperability.

3. The Department desires enhancements to the current situation, but also wants to retain the simplicity of operation.

4. Added system capabilities are desired.

5. The tactical channels and fire ground type operations are working very well and should not be changed. All system enhancements should be directed at creating very robust radio systems.

6. In the near future the Department will require the addition of 5 desk-top radios, and 40 mobile data terminals.

Additional Comments

1. There are significant issues with the current dispatch situation; the issues are with consistency; capability; lack of automation for routine tasks; and problems in operational opinions and direction or the lack thereof.

2. There are also issues with the dispatch governance and finance; the Department feels that it does not know all it should about the Center.

3. CTA received a map that is being retained for coverage study purposes.

The draft of this record was sent to Sgt. Jason Jarrett on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Springhill Fire Department**

File Name: **Gallatin County - Springhill FD Interview Record.doc**

Date of Interview: **4/06/05**

Location of Interview: **Old Chicago Restaurant**

Persons Interviewed: **Bruce Wright, Chief Springhill Fire**

CTA Interviewer: **David Anderson**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Springhill FD has 15 volunteers and no structure fire capability or training. The department is set up for wild land fires. There is one class 6 truck and one water tender, each equipped with a mobile radio.

2. Springhill service area is in between the Bridger Range and Springhill Rd (19th Street north), about 10 miles north of Bozeman.

Present Situation

1. Springhill provides mutual aid primarily to Belgrade and to some extent, Amsterdam. In a busy year, Springhill responds to 6 incidents.

2. The department has 4 portables, most of which are kept at the station.

3. The Chief indicates there are no serious problems effecting this small fire operation.

Present Problems

1. The department likes the digital pagers with their ability to store the message and be usable in high noise environments. However, there are too many administrative group pages that do not apply to people in this department. Possibly the pager addressing structure can be improved to target the correct people.

2. Coverage from North Repeater (Bridger) is spotty since the service area is in the shadow of the Bridger Range.

3. The department currently has 6 pagers to serve 15 volunteers. Need about 20 total pagers.

Future Requirements

1. Would like a portable radio per volunteer – about 20 total radios would allow for some units in the station.

2. GPS capability on the radios to help locate people.

3. Better (and additional) radio training.

The draft of this record was sent to Bruce Wright on May 16, 2005.

Springhill Fire Department
5680 Springhill Community Road
Belgrade, MT 59714

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Three Forks Fire**
File Name:	**Gallatin County - Three Forks Fire Interview Record.doc**
Date of Interview:	**3/29/05**
Location of Interview:	**Three Forks Fire Department** **13 East Date Street** **Three Forks, MT 59752**
Persons Interviewed:	**Chief Bruce Felz**
CTA Interviewer:	**Mike Dye, Dave Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Department provides fire suppression service for the city of Three Forks and the near surrounding area, about 200 square miles.

<u>Present Situation</u>

1. The Department has currently 7 mobiles, 1 base station, and 20 portables.

2. 10 of the portables are older ICOM radios (Model IC F3S-2) that may not be narrow band capable.

3. 1 mobile is a very old Bendix-King radio that will need replacing.

4. The Department uses mainly the Fire North and North repeater channels.

Present Problems

1. There is some radio interference between Fire North and the North Repeater.

Future Requirements

1. 10 of the portables and 1 mobile will need replacement soon.

2. In the next 5 to 10 years there may be an additional sub-station. This will require at least 3 added mobiles.

Additional Comments

1. The Radio Usage Survey form will be forwarded to Ben Hess later.

The draft of this record was sent to Chief Bruce Felz on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Three Forks Marshall's Office**
File Name:	**Gallatin County - Three Forks Marshall Interview Record.doc**
Date of Interview:	**3/31/05**
Location of Interview:	**Three Forks Marshall's Office** **206 South Main Street** **Three Forks, MT 59752**
Persons Interviewed:	**Troy Burdick**
CTA Interviewer:	**Mike Dye**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Marshall provides law enforcement services for the City of Three Forks and the surrounding areas.

<u>Present Situation</u>

1. The Marshall's Office currently has 3 mobiles, 6 portables, 1 desk-top unit, and 6 pagers.

2. The mobiles are Unidens, the portables are Kenwoods. All are fairly new but need to be checked for P.25 compliance and will probably require replacement.

3. The agency has recently obtained 1 Motorola Advisor II pager in place of the standard Advisor I. This seems to work better and is easier to use.

4. The agency is dispatched by the 9-1-1 Center but receives most of its calls in person or by personal cell phones.

5. The City is using a SWIFT records management system.

Present Problems

1. Portable radio coverage is minimal at best. The agency often crosses into Broadwater County and has very poor radio coverage in that area. There is also poor coverage when moving east towards Manhattan. Otherwise they are suffering the same coverage issues as the Sheriff's Office.

2. The pagers often do not work inside buildings.

3. The agency has no mobile data terminals.

4. Sharing the same channel and dispatcher with the Sheriff's Office, Belgrade PD, Amsterdam PD, and Manhattan PD is causing crowding problems. The officers often have problems reaching the dispatcher. The agency feels that the dispatchers are trying very hard, but they are simply overworked.

Future Requirements

1. The agency expects to grow to 10 officers in the future. The portables and pagers would need to be increased to that number. The Uniden mobile will probably need replacement and the fleet will increase to 7. The desk-top is an older model and will need replacement as well.

2. There is a need for mobile data terminals for each vehicle with 3 at present and 7 in the future.

3. Would like to explore creating a separate, added channel and dispatcher for the cities.

Additional Comments

None.

The draft of this record was sent to Troy Burdick on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**West Yellowstone Police, Fire, and Public Works Departments**
File Name:	**Gallatin County - West Yellowstone PD FD PW Interview Record.doc**
Date of Interview:	**4/05/05**
Location of Interview:	**West Yellowstone Fire Training Room**
Persons Interviewed:	**Ken Davis, Assistant Public Services Director**
CTA Interviewer:	**David Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. West Yellowstone (WY) operates a PSAP in the southern end of Gallatin County handling calls from the 646 and 640 telephone exchanges. This interview combines the needs of WY Police, Fire, 911 center, and Public Works departments.

2. The 911 center also provides dispatch service for the Montana Highway Patrol, the Forest Service. There is significant interface with, and some dispatch for the National Park Service. This overall operation is described as "the model of cooperation" between local, State, and Federal resources.

3. The relative isolation of WY in southern Gallatin county means that local resources must be self-sufficient for about two hours in the event of a major situation until resources from outside can begin to assist.

Present Situation

1. The dispatched channels include the Fire and EMS channel (not repeated), the Police dispatch channel (not repeated), and Public Works channel. Dispatchers also have access to the State Mutual aid channels. The control stations for these non-repeated channels are located in the back room of Police dispatch. Dispatch control stations can reach the South Repeater (at Eagle Head) for contact with Bozeman. Two resident County Sheriff Deputies operate on this channel. There is a repeated Public Works channel that is not accessible to dispatchers. The PW channel is a remoted radio in another building that lacks a generator.

2. Local radio coverage is described as good and generally provides a 30-40 mile range. All equipment, console, radios, desktop stations, etc have enough channel programming capacity to hold the locally used channels.

3. The Zetron paging entry computer is local to West Yellowstone and is tied into the Gallatin County paging system. A paging entry computer is located at West Yellowstone dispatch, the controller is in Bozeman, and the transmitter is at Horse Butte.

Present Problems

1. West Yellowstone law enforcement and fire is concerned about continued radio compatibility with federal agencies. The Federal Government including the National Park Service has used narrowband equipment since 2002 and has mandated Project 25 digital operation by 2007. WY agencies probably have a higher level of interaction with federal agencies than most Gallatin County departments, underscoring their need for new equipment in the near future.

2. The vulnerability of the Quest microwave down the Gallatin valley is a concern for critical phone service for WY.

Future Requirements

1. An additional new repeated channel in town is needed that would provide denser in-building coverage. This channel would serve as a law and fire TAC channel. Public Works suggests the City water tank as a site offering a 134' antenna mounting height and an equipment area. The local preference for backup generator fuel is natural gas.

2. Other tower sites in the area that should be considered in the coverage design are the Horse Butte site and

The draft of this record was sent to Ken Davis on April 26, 2005.
Corrected draft was returned to CTA Communications on May 12, 2005.

West Yellowstone Public Works
400 Yellowstone Ave
West Yellowstone, MT 59715

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Gallatin County – Willow Creek Fire & Three Forks Ambulance**
File Name:	**Gallatin County - Willow Creek Fire Interview Record .doc**
Date of Interview:	**3/29/05 and 3/31/05**
Location of Interview:	**Willow Creek Fire Department P.O. Box 113 Willow Creek, MT 59760**
Persons Interviewed:	**Chief George Reich & Bill Frank**
CTA Interviewer:	**Mike Dye**

Due to scheduling, these two agencies were handled together but in two separate interviews.

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The agency provides fire and ambulance service in the Willow Creek and Three Forks and surrounding areas.

2. The agencies are dispatched by pager from the Bozeman 9-1-1 Center.

<u>Present Situation</u>

1. Three Forks Ambulance has: 3 old model mobiles, 20 portables - 10 of which are older models, and 12 Advisor Gold pagers.

2. Willow Creek Fire has: 7 mobiles - 2 are older models; 22 portables - 11 of which are over 5 years old; 1 very old desk-top; and 26 Advisor Gold pagers.

3. There was in the past a serious pager coverage problem. This has been corrected to a large degree by adding the Round Springs pager site.

Present Problems

1. They do have good radio coverage with Fire North; coverage is weak and very scratchy. They are concerned that parts of their response zone have no coverage at all.

2. Often traffic is garbled in the outbound from dispatch and dispatch cannot hear the portables.

3. Had some radio interference issues that have been cut by adding a PL code. However, there is some PL programming difference between Three Forks Ambulance and Three Forks Fire that prevents communications.

4. The agencies are troubled with receiving "ghost pages".

Future Requirements

1. The agencies would very much like to move away from data paging only and move to a voice/data dispatch system.

Additional Comments

1. The older radios will probably need to be replaced in order to become narrow-band capable.

The draft of this record was sent to Chief George Reich on April 26, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Yellowstone Club Fire Department**
File Name:	**Gallatin County - Yellowstone Club FD Interview Record.doc**
Date of Interview:	**4/05/05**
Location of Interview:	**Yellowstone Club, Administration Building**
Persons Interviewed:	**Steve Hauck, Chief Yellowstone Club Fire**
CTA Interviewer:	**David Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Yellowstone Club (YC) is a private residential community west of Big Sky in Madison County. The Fire Department is a private stand-alone company that will primarily serve the club property and residents and is scheduled to begin operation mid 2005. The department anticipates about 10 calls for service per year.

2. YC, when fully operational in 2005, will have a staff of 18 paid firefighters. The department is funded by the property owners of YC.

3. YC (in Madison County) comes under Gallatin County jurisdiction for Fire and Law Enforcement service because of lack of road access from the Madison side of the mountains.

<u>Present Situation</u>

1. The fire station is under construction and almost complete. Three new vehicles have been purchased and will be delivered this spring. They include a Class A pumper, a pumper/rescue vehicle, and a Type 1 4 x 4 ambulance.

The Chief's YC staff vehicle serves as the command vehicle. All vehicles are equipped with UHF mobiles for YC communications and VHF mobiles for interoperability with the County.

2. YC owns a Kenwood trunked radio system that serves Fire and security. The department has 4 portables most of which are kept at the station.

3. Until YC Fire is operational, the club is under contract with Big Sky FD for fire service. Mutual aid agreements are being drawn up between Big Sky and YC and are expected by mid 2005. Because YC has only one set of Fire vehicles, some restrictions are anticipated on the use of YC vehicles off the property.

4. Calls for fire/EMS service are anticipated to arrive through phone calls to club security. However, 911 calls are routed to Gallatin 911 and then are paged out like any other county call.

<u>Present Problems</u>

1. Like Big Sky, YC is susceptible to link outages the affect paging for the area. Furthermore, the County paging system lacks the diagnostic package to alert dispatch when the Andesite link is down.

2. YC is segregated from Gallatin and Madison County by use of UHF radio rather than VHF. This would be a problem were it not for YC's willingness to double equip the department with radios to maintain interoperability and support mutual aid. YC FD personnel should also at least have access to a cache of VHF portables to fully support this interworking.

<u>Future Requirements</u>

1. YC FD wants to support a strong cooperative relationship with the Counties. One option discussed that would be of mutual benefit was establishment of a good new tower site on YC property. Potentially, this could serve as a UHF site for YC, a good VHF site for Gallatin and Madison Counties, and a microwave drop for improved paging link reliability. We will explore this idea.

2. Plans were mentioned for a second fire station, another large engine and tender, and possibly a PSAP to handle YC calls for service.

Additional Comments

1. CTA has not received a completed radio survey from this agency.

The draft of this record was sent to Steve Hauck on April 26, 2005.

Yellowstone Club Fire Department
#1 Yellowstone Club Trail
Big Sky, MT 59716

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Montana Public Safety Services Bureau**
File Name:	**CTA Communications - Montana PSSB Interview Record.doc**
Date of Interview:	**4/01/05 & 4/04/05**
Location of Interview:	**Bozeman & Helena, MT**
Persons Interviewed:	**Jenny Hansen, Chris Christensen**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Public Safety Services Bureau (PSSB) is part of the Information Technology Services Division of the Department of Administration. The Public Safety Services Bureau manages statewide planning of public safety communications and the State's 911 program. The bureau organizes, plans, and works with local, state, federal, and various public service agencies in the development and implementation of a statewide strategic plan for public safety communications. To that end, the Public Safety Services Bureau assists state and local government agencies in identifying potential sources of local, state and federal funding for public safety communications infrastructure, makes recommendations on how to acquire funding, develops grant proposals, and evaluates other efforts to secure funding. Jenny Hansen is the Bureau Chief. Chris Christensen is the Communications Technology Manager.

2. The Statewide Interoperability Executive Council (SIEC) provides policy-level direction in matters related to planning, designing and implementing guidelines, best practices, and standard approaches to solve Montana's public safety communications interoperability problems and to leverage any opportunity in support of a statewide system, including seeking federal or other funding, for statewide interoperability.

In 1996, then Governor Racicot established the Montana Public Safety Communications Committee (MPSCC). After a period of inactivity, Governor Martz reestablished the MPSCC as the SIEC. The PSSB provides staff support for the SIEC.

3. The PSSB is also responsible for administration the State of Montana's 911 program. At the present time 18 jurisdictions in Montana (including Gallatin, Meagher, and Park Counties and the City of West Yellowstone) provide Enhanced 911. Madison and Sweet Grass Counties are in the process of implementing Enhanced 911.

Present Situation

1. Currently, most of the public safety entities in Montana use VHF – High Band for communications. Billings PD is the only law enforcement agency using 800 MHz, and Great Falls PD is the only law enforcement agency using UHF (FYI: they've recently submitted an Appropriation request (FY06) to go VHF, swapping out the old, in with the (future) new, etc)..

2. There have been 4 previous attempts to plan for (it never made it to even "discussion level" at the legislature a statewide radio system. These attempts have failed usually because of the lack of local buy-in (among many other political factors from what I understand).

3. The SIEC is encouraging pilot or *Concept Demonstration Projects (CDP).* The process is initiated by a regional consortium submitting a Project Abstract which is a description of the basic concept to be demonstrated by the project. If the abstract is approved by the SIEC, the PSSB will then assign a special projects coordinator to assist with the project.

4. The SIEC has adopted APCO P25/TIA 102-A as the standard for public safety communications systems in the State. Because of the high penetration of the VHF - High Band portion of the spectrum, the SIEC is recommending that operations remain in this frequency band in order to facilitate both interoperability and an incremental, phased approach.

5. To date, 4 CDPs have been approved by the SIEC. CDP 2 (Southwest Interoperability Project) involves Lewis and Clark County. This includes Helena, the State Capitol. This CDP involves the installation of a P25 VHF digital trunked system. They received a $6,000,000 COPS Interoperability Grant to fund the project start-up. The State of Montana has requested an additional $2,000,000 in federal funding for next year to allow the addition of Jefferson and Broadwater Counties.

CDP 1 (Northern Tier Interoperability Project) involves the 12 counties that form the northern border with Canada. The project involves installing a digital microwave backbone linking the dispatch centers, EOCs, Montana National Guard armories, the Montana Highway Patrol, the Montana Department of Transportation as well as various Tribal and Federal agencies. The project also involves providing P25 digital radios and mobile data terminals. The project received extensive funding through the Wartime supplemental Appropriation. The State of Montana, with the approval of the legislative body, will contribute $3.6M (General Fund monies) toward the NTIP, integrating (or tying to) L&C County's upgrades (Master Zone Controller). CDP 3 involves four counties (Anaconda-Deer Lodge, Beaverhead, Butte-Silver Bow and Granite) who have formed the 15-90 Corridor Interoperable Communications Consortium to conduct a needs assessment of the current communication environment and write an implementation strategy for interoperable communications.

6. 5 other consortiums have been formed or are in the process of being formed. These include: the Eastern Tier; Big Sky 12; Tri-County; Missoula area; and the Central Montana Interoperability Consortium.

Present Problems

1. Funding is the most significant challenge. The PSSB, under Jenny's leadership have been very successful in obtaining federal funds. However, the federal funding received to date amounts about 10% of the total needed.

2. Geographically, Montana is the 4th largest state in the nation. It covers nearly 147,000 square miles and encompasses over 550 miles of international border, mountainous terrain, and vast flatlands. The population of 870,000 is unevenly distributed. Over half of the state's residents live in one of the six counties with more than 50,000 population. The other 50 counties have a total population of less than 400,000.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Jenny Hansen on May 3, 2005.
Corrected draft was returned to CTA Communications on May 5, 2005.

M:\FILES\20077 SCMIC\interview\Madison County\FINAL\CTA Communications - Montana PSSB Interview Record.doc

CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**County Commissioners & Road Foremen**
File Name:	**Madison County - County Commisioners Interview Record.doc**
Date of Interview:	**4/06/05**
Location of Interview:	**Virginia City, MT**
Persons Interviewed:	**Dave Schulz, County Commissioner** **Ted Coffman, County Commissioner** **Frank Nelson, County Commissioner** **Ray Rowberry, Road Foreman, District 1**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. There are three County Commissioners in Madison County. Each Commissioner is also the Road Commissioner for his district.

2. Madison County is 78 miles long and 60 miles wide. It covers 3,528 square miles.

3. The road department districts operate somewhat independently. Each district has a foreman who reports to his respective county commissioner.

Present Situation

1. The Road Department operates on its own channel. They do have access to the Gold Mutual Aid Channel to communicate with other agencies. The Road Department does support wild land fire fighting.

2. County Weed control also uses the same frequency as the road department. They have 5 vehicles some of which could be used for fire control. They are using ICOM radios.

3. Each District has its own shops. The shops do not have base stations.

4. After hours call out is done by telephone.

Present Problems

1. There are a number of areas where there is poor or no coverage for both radio and cell phone. These areas were indicated on maps provide to CTA.

2. The road department is using low power mobiles. The equipment is old and unreliable. There is a concern about safety issues with personnel working alone and not being able to summon assistance if needed.

3. There are a number of high value properties in area of poor coverage.

Future Requirements

None.

Additional Comments

1. The Sheriff's Office does radio checks of law enforcement and fire units on Monday mornings. The Road Department is not included.

2. Since this interview was conducted, a base station has been installed at the Alder Shop. The report has been amended to reflect this change.

The draft of this record was sent to Frank Ford on May 9, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Madison County Dispatch**

File Name: **Madison County - Dispatch Interview Record.doc**

Date of Interview: **4/06/05**

Location of Interview: **Virginia City, MT**

Persons Interviewed: **Janet Fortner**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The dispatch function is part of the Sheriff's Department. The dispatch center serves as the Public Safety Answering Point for Madison County. They also dispatch all county and local public safety agencies in the county (2 law enforcement, 6 fire, and 2 ambulances).

2. Janet Fortner is the Terminal Agency Coordinator (TAC) and lead dispatcher.

Present Situation

1. Madison County currently has basic 911 service. They are working on upgrading to Enhanced 911 this year.

2. There are 4 full-time and 2 part-time dispatchers.

3. The center is equipped with one full and one partial position.

Present Problems

1. The dispatch center is using a Motorola Centracom 2 console. That model is no longer supported by Motorola and parts are no longer available. In addition, the paging encoder in use has a capacity of 24 tones. It is filled to capacity and limits the ability to add more users. There is no grounding in the facility. There is a lack of adequate security and HVAC.

2. They are not able to communicate with surrounding agencies easily.

3. The instant recall recorder for radio traffic is not working. One of the CJIN computers was out of service because of a bad hard drive.

4. Need better communications with own and outside agencies.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Frank Ford on May 9, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**East County Fire**
File Name:	**Madison County - East County Fire Interview Record.doc**
Date of Interview:	**4/05/05**
Location of Interview:	**Madison Valley Rural Fire Dept Station 1**
Persons Interviewed:	**Shawn Christensen, Madison Valley Rural, FD #1** **Scott McClintic, Madison Valley, Rural FD #2** **Joe Husar, Harrison Rural FD & Harrison QRU**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. There are 7 primary rural fire districts in Madison County. 3 (Madison Valley Rural 1 & 2 and Harrison) are in the Madison Valley.

2. Madison County is part of 3 different US Forest Service Districts.

Present Situation

1. The fire and rescue units are alerted by pager and communicate with dispatch on the Sheriff's channel. There are 3 repeaters on the channel as well as a simplex base in Virginia City.

2. Harrison and Madison Valley Station 2 have installed a "paging booster" which has helped but still have issues with pagers being activated.

3. The East County fire units can access the USFS Lazyman repeater. That repeater is not monitored 24 hours a day. The Lazyman repeater is located in the center of the Gravelly Range and provides coverage throughout the Gravellys, northern Centennial Valley and the Upper Ruby Valley.

4. Madison County has recently purchased 10 satellite phones for use by the various public safety agencies.

<u>Present Problems</u>

1. Coverage is a significant issue. In much of the outlying areas, there is little or no coverage. Jack Creek Canyon is a particular area of concern. While there is no public access, it is the alternate route to the Big Sky Ski Resort. Sometimes the departments have to use 4 or 5 vehicles to relay. A third area is the Bear Trap Gulch between Norris and Bozeman. There is an average of 2 tractor trailer incidents with hazardous materials issues in this area per year. So far this year there have been 12 motor vehicle accidents in this area. The area with the most accidents is between Mile Marker 3 and 10, especially around mile marker 7. There is little to no communications in this area, including cell phone.

2. Most of the equipment being used is second hand government surplus equipment that is 10-15 years old and not narrowband capable. With the USFS having moved to narrowband communications, this limits the ability to use those channels. The departments have to use high power (110 watt) m radios in order to get through to dispatch. Lower power units don't work.

3. As people move into secluded canyons, the demand for service is increasing. Recreational use is increasing which results in increased rescue calls in the forest areas. Back country rescue calls have increased 3 times in the last 4 years.

4. In addition to two-way radio issues, there are issues with pager activation in a number of areas. With the limited number of available responders, a fire fighter not receiving pages becomes more of an issue than it might be in other areas.

5. No Communications with Fremont County ID. Fremont County could be used for mutual aid, but without communications, that isn't happening.

6. Wireless calls in the southern end of the county frequently use a tower in Idaho. Wireless 911 calls using those towers are answered in Idaho Falls and then transferred to Madison County, ID. There is often difficulty getting the calls routed to the correct agency.

7. Training in the proper use of the radio is needed.

Future Requirements

None.

Additional Comments

1. Island Park, ID has good communications. Sawtell Peak is a developed site and may have good coverage into Madison County.

The draft of this record was sent to Frank Ford on May 9, 2005.
Corrected draft was returned to CTA Communications on May 31, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Ennis Ambulance**

File Name: **Madison County - Ennis Ambulance Interview Record.doc**

Date of Interview: **4/05/05**

Location of Interview: **Ennis, MT**

Persons Interviewed: **Susie Sprout**
Ginger Guinn

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Ennis Ambulance Service provides Emergency Medical Services (EMS) in the Madison River Valley.

Present Situation

1. Currently the ambulance service has 1 EMT-I (Intermediate) and 20 EMT –B (Basic) responders.

2. The Ennis Ambulance Service responded to 202 calls in 2004. That is twice the number from ten years ago. They are dispatched by the Sheriff's Department.

3. The Ennis Ambulance Service has two units. Both are equipped with GPS handheld devices.

4. Madison County currently provides Basic 911 service. The County is currently in the process of establishing addresses countywide.

Present Problems

1. The radios have better coverage than cell phones, but generally there is very poor coverage. There are numerous times when a chain consisting of multiple units must be established from the scene in order to communicate outside of the immediate scene. Frequently, there are not enough responding units in order to establish communications.

2. Communications equipment is old (1988).

3. With the influx of new houses, there is much difficulty in locating the new places.

4. Satellite phones are cumbersome and expensive to use.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Frank Ford on May 9, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Town of Ennis, MT**

File Name: **Madison County - Ennis Mayor Interview Record.doc**

Date of Interview: **4/05/05**

Location of Interview: **Ennis Town Hall**

Persons Interviewed: **Ralph Hernandez, Mayor**
Duane Martian, Director of Public Works

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Ralph Hernandez is the Mayor of the Town of Ennis.

2. Duane Martian is the Director of Public Works.

Present Situation

1. Earthquake Lake, on the Madison River, was created as the result of an earthquake in 1959. It is just downstream of Hebgen Lake.

2. The Town of Ennis is on the Madison River. Much of the Town is in the area that would be flooded if the Hebgen Lake or Earthquake Lake dams failed, which it could in another earthquake. It would take 2-8 hours for the crest to reach Ennis.

3. The Ennis area is experiencing growth.

Present Problems

1. Mayor Hernandez is concerned about a catastrophic failure of the dams. At the present time, there is no warning system for the town. The plan would be to have police, sheriff and fire units drive through the area alerting people with sirens and mobile public address systems.

2. The fire department outdoor siren was deactivated when the fire department switched to using pagers. They are looking into reactivating the siren. It is uncertain what the current condition of the siren is. There is a private citizen who is willing to donate funds to reactivate the siren.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Ralph Hernandez on May 3, 2005.

Mayor Ralph Hernandez
P.O. Box 147
Ennis, MT 59729

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Ennis Police Department**

File Name: **Madison County - Ennis Police Department Interview Record.doc**

Date of Interview: **4/05/05**

Location of Interview: **Ennis, MT**

Persons Interviewed: **Tom Tighe, Constable**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Tom Tighe is the Constable for the Town of Ennis. He is a one officer department.

Present Situation

1. Tom works primarily within the town limits. He does respond outside of the town on a mutual aid basis.

2. Madison County uses two repeaters –one on the Madison Valley side of the County and the other on the Ruby Valley side of the County.

3. Handheld coverage in Ennis is generally adequate.

Present Problems

1. There are large gaps in radio coverage especially south of Ennis by the Reynolds Pass area.

2. Units on the Madison Valley side of the county cannot hear units on the Ruby Valley side of the county and vice-versa.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Tom Tighe on May 3 2005.

Tom Tighe
Ennis Police Department
P.O. Box 147
Ennis, MT 59729

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Madison County Health Department**
File Name:	**Madison County - Health Dept Interview Record.doc**
Date of Interview:	**4/05/05**
Location of Interview:	**Ennis, MT**
Persons Interviewed:	**Jill Steely**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Jill Steely is the Public Health Administrator for Madison County.

2. She is responsible for the preparation of Public Health Emergency Plans.

3. She is responsible for immunization and community education programs.

<u>Present Situation</u>

1. The Madison County Health Department is one year old. They are in the process of hiring a Public Health Nurse.

2. They held a table top exercise last year. Jill would like to hold another this year.

3. There are two doctors, two physician's assistants and a nurse practitioner based at the Madison Valley Hospital. There are two doctors and two physician's assistance at the hospital in Sheridan.

Present Problems

1. Jill has no communication other than telephone, fax or email. The state supplied cell phone does not work in parts of Madison County. It does not work at all in Virginia City where Jill lives and works.

2. The Federal and State governments issue Health Alert Network messages. The only way that Jill can receive them is by email. There can be a delay in getting the information.

3. With the lack of communications, there is difficulty in notifying the medical personnel.

Future Requirements

1. Working pagers for the Public Health Administrator and the Public Health Nurse.

2. Two-way radios would also be helpful.

Additional Comments

None.

The draft of this record was sent to Jill Steely on May 3, 2005.
Corrected draft was returned to CTA Communications on May 27, 2005.

Jill Steely, Administrator
Madison County Health Department
P. O. Box 278
Virginia City, MT 59755

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Madison Valley Hospital**

File Name: **Madison County - Madison Valley Hospital Interview Record.doc**

Date of Interview: **4/05/05**

Location of Interview: **Ennis MT**

Persons Interviewed: **Bruce Hayward, D.O.**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Madison Valley Hospital is a 9 bed facility.

2. Dr. Hayward is the Chief of Staff.

Present Situation

1. The hospital currently has a base station on its own channel that is used for communication with the ambulance and for paging of hospital personnel. The antenna is located on the hospital roof.

2. The hospital is seeking designation as a level 4 Trauma Center.

3. The hospital is looking to build a new facility adjacent to the exiting facility.

Present Problems

1. The hospital has difficulty in contacting key staff in an emergency.

2. There are areas with poor radios and cell phone coverage leaving medical providers without the ability to get information to and from the medical doctors.

3. Privacy concerns, particularly with HIPPA, are increasing.

Future Requirements

1. The hospital recently had an on-site assessment for accreditation. The lack of communications capability was cited as an issue.

Additional Comments

1. Mobile computers with mapping would be helpful for the ambulance.

The draft of this record was sent to Bruce Haywood on May 3, 2005.
Corrected draft was returned to CTA Communications by fax on May 9, 2005.

Bruce Hayward, D.O.
Madison Valley Hospital
P.O. Box 547
Ennis, MT 59729

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Missoula County**
File Name:	**Madison County - Missoula County Interview Record.doc**
Date of Interview:	**May 17, 2005**
Location of Interview:	**Telephone**
Persons Interviewed:	**David McGinnis**
CTA Interviewer:	**Nathan McClure/David Anderson**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Sheriff of Missoula County is the chief law enforcement officer and is responsible for the enforcement of state and county laws and statutes. The Missoula County Sheriff also serves as coroner, investigating all unattended deaths or deaths that may be criminally caused.

2. David McGinnis is a Senior Deputy with the Missoula County Sheriffs Office. He is responsible for communications. He is also the APCO Local Advisor for Montana.

3. Missoula County covers 2,600 square miles.

Present Situation

1. Missoula County and the City of Missoula have implemented a VHF High-band conventional system. There are five remote sites linked by microwave. These sites provide overlapping coverage. They have six to 10 channels at each site.

2. They are using Motorola Quantar repeaters base stations and a Motorola "Astro-TAC 300"comparator. The comparator selects the best signal. The selected or voted audio is then rebroadcast over the selected transmitter. Field personnel do not have to manually switch between repeaters. Dispatch personnel may have to select the transmitter if there has been more than five seconds since the last transmission on the tower they want to use.

3. The transmitter steering interface was built locally. The transmitters are set up to operate like a simulcast system, but the steering interface inhibits all but the selected transmitter from actually transmitting.

4. When they were installing the system, they chose repeater receive frequencies in the upper portion of the VHF high band portion of the spectrum (158-159 MHz) and repeater transmit frequencies in the lower portion of the same band (151-155 MHz). This reduces the interference potential.

Present Problems

1. None.

Future Requirements

1. None.

Additional Comments

1. They are looking to add simulcast zones to the system.

2. Some limited use is being made of P25 digital communications with encryption.

The draft of this record was sent to David McGinnis on May 25, 2005.

David McGinnis
Sheriff's Dept.
200 West Broadway
Missoula, MT 59805

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Montana Department of Emergency Services**

File Name: **Madison County - Montana DES Interview Record.doc**

Date of Interview: **4/04/05**

Location of Interview: **Helena, MT**

Persons Interviewed: **Sheri Lanz, Homeland Security Coordinator, Montana DES**

Gary Hindoien, Program Specialist, Montana DES

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Montana Disaster and Emergency Services is a Division of the Montana Department of Military Affairs. Sheri Lanz is the Homeland Security Coordinator. Gary Hindoien is a program specialist in Homeland Security Bureau.

2. The Montana DES serves as the State Administrative Agency for U. S. Department of Homeland Security (DHS) funding and other resources.

Present Situation

1. The State Homeland Security Strategy for Montana is to build local and regional capabilities that support regional and statewide homeland security initiatives by effectively working in a multi-disciplinary manner to detect, mitigate, prepare for, respond to and recover from, a WMD terrorism incident.

2. Interoperable communications projects have been identified as a high priority in the State Homeland Security Strategy. The second highest priority goals is to “Establish a statewide, interoperable public safety system that will link the independent wireless voice and data systems (incl. 9-1-1 and public safety radio systems) used by federal, state, local, tribal and private sector responders.”

3. In 2001, the State performed a threat assessment. The 56 jurisdictions were prioritized based upon the assessment of both the Threat of an incident occurring and the vulnerability to an incident. Each of the 63 jurisdictions was then ranked. Gallatin County had the second highest threat assessment in the state.

4. Montana has traditionally attracted activist/extremist individuals and groups because of its low population, large geographic area, and relative isolation. Groups active in Montana vary from white supremacists to single issue groups, such as environmental extremists.

5. Since the creation of the State Homeland Security Grant Program and the Law Enforcement Terrorism Prevention Program, the State of Montana has received approximately $53,379,101 in DHS funding.

<u>Present Problems</u>

1. The amount of DHS funds received by the State of Montana in FY 05 has decreased from the amount received the previous year. In 2004, Montana received $20,462,000. The amount allocated for the current fiscal year is 33% less ($13,567,101).

2. Initially DHS funding was distributed on the basis of population. Because Montana has a relatively small population, the amount the State received among the lowest received compared to other states.

3. Initial estimates are that, while overall DHS funding may increase, the amount allocated to the states through the State Homeland Security Grant Program will continue to decrease. More funds are being allocated to the Urban Area Secuirty Initiative. Montana has no areas that are included in the designated DHS Urban Areas.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Sheri Lanz on May 3, 2005.
Corrected draft was returned to CTA Communications on June 9, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Montana Department of Natural Resources and Conservation.**
File Name:	**Madison County - Montana DNRC Interview Record.doc**
Date of Interview:	**4/05/05**
Location of Interview:	**Helena, MT**
Persons Interviewed:	**Eric Lasell, Communications Engineer**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Montana Department of Natural Resources and Conservation (DNRC) was established July 1, 1995, as the result of legislative reorganization of Montana's natural resource and environmental agencies. DNRC has nearly 500 employees organized into seven divisions: Centralized Services, Conservation and Resource Development, Forestry, Oil and Gas Conservation, Reserved Water Rights Compact Commission, Trust Land Management, and Water Resources.

2. The Forestry Division is responsible for planning and implementing forestry programs statewide. Forestry responsibilities include protecting Montana's natural resources from wildfire, regulating forest practices, and providing a variety of services to private forest landowners.

3. Over 50.3 million acres of forest and non-forest state and private lands are protected by the state through a series of protection systems. These systems include forest fire districts, affidavit units and cooperative fire control counties.

Actual protection is afforded by the state, either through its own organization, or in support of county forces, or through contracts with the Forest Service, Bureau of Land Management, and the Flathead Indian Agency.

Present Situation

1. The DNRC Fire Bureau has jurisdiction in those areas where the state provides actual protection. They work closely with the US Forest Service. The DNRC has non-linked repeaters located in the areas where the DNRC has primary jurisdictions for wild land fire protection.

2. The DNRC is in the process of replacing their base stations with narrow-band capable units. It will take approximately 3 more years to complete the process.

Present Problems

1. There has been an issue with the frequency coordination for the new Lewis and Clark system. As a result, it is causing interference in a number of areas.

Future Requirements

None.

Additional Comments

1. There may be some DNRC channels available for sharing in the area.

The draft of this record was sent to Eric Lassel on May 3, 2005.

Eric Lassel, Communications Engineer
Montana Department of Natural Resources and Conservation
2705 Spurgin Road
Missoula, MT 59801

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Montana Dept of Transportation**

File Name: **Madison County - Montana DOT Interview Record.doc**

Date of Interview: **4/04/05**

Location of Interview: **Helena, MT**

Persons Interviewed: **Kevin Bruski, Chief of Communications**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Montana Department of Transportation (MDT) is responsible for maintaining over 10,800 miles of highway and about 2,100 bridges.

2. The Department of Transportation has 5 districts. Those districts are further subdivided into a total of 10 divisions. Most of the SCMIC is in the Butte District and the Bozeman Division.

3. In addition to serving as the Chief of the Communications Bureau for MDT, Kevin Bruski is the ASHTO Frequency Coordinator for Montana.

<u>Present Situation</u>

1. MDT is moving to narrowband. They have no plans to move to digital nor are they considering trunked.

2. The MDT has 8 sites in the SCMIC area; 2 of those sites are County owned; 3 of the sites are shared with the USFS; 2 are MDT sites, and 1 is a leased site.

Present Problems

1. MDT is being asked to vacate its site on Story Hill. They are interested in a Memorandum of Understanding for access to a new site and microwave channel use in exchange for providing maintenance to microwave system.

Future Requirements

1. Use of the microwave backbone if deployed at sites where MDT resides.

Additional Comments

1. MDT may be interested in assisting with site development.

The draft of this record was sent to Kevin Bruski on May 3, 2005.
Corrected draft was returned to CTA Communications on May 9, 2005 via email.

Kevin Bruski, Chief
Communications Bureau
Montana Department of Transportation
PO Box 201001
Helena, MT 59620-1001

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Montana Highway Patrol**

File Name: **Madison County - Montana Highway Patrol Interview Record.doc**

Date of Interview: **4/04/05**

Location of Interview: **Helena, MT**

Persons Interviewed: **Charlie Larson**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Montana Highway Patrol (MHP) is responsible for managing highway traffic safety in the state. It is the largest law enforcement agency in Montana, with about 200 officers and 70 civilian employees in eight districts throughout the state.

2. The MHP Communications Section manages and maintains the Patrol's radio communications system, including supervision of the communication center (dispatch).

3. The MHP has a supervisor and 3 technicians who maintain the MHP system

Present Situation

1. The MHP field forces are currently effectively 34 troopers short of the authorized strength. 17 MHP troopers are on active military duty in Iraq, and there are 17 vacancies.

2. All of the current MHP base stations are narrow-band capable.

3. The MHP is currently building out a statewide mobile data system. The first phase was installed in 5 counties (Lewis & Clark, Gallatin, Cascade, Yellowstone, and Silver Bow). Local agencies are using the system as well. Currently, there is a microwave system linking Butte with Helena.

4. Phase 2 of the mobile data system will extend the mobile data system east to Miles City in Custer County. As part of Phase II, the microwave will be extended from Butte through Bozeman to Billings. This extension will involve three microwave sites in Gallatin and Park Counties (High Flat, Bozeman Flats, and Sheep Mountain).

Present Problems

None.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Charles Larson on May 3, 2005.

Charles Larson
Montana Highway Patrol
P.O. Box 201419
Helena, MT 59601-1419

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Madison County Nursing Homes**
File Name:	**Madison County - Nursing Homes Interview Record.doc**
Date of Interview:	**4/05/05**
Location of Interview:	**Ennis, MT**
Persons Interviewed:	**Peter Birkholz**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Madison County has 2 nursing homes – one in Ennis, the other in Sheridan.

2. Peter Birkholz is the administrator of both facilities.

Present Situation

1. There are a total of 40 employees.

2. The Ennis facility has a capacity of 40 patients; the Sheridan facility has a capacity of 39 patients.

3. Currently the telephone is the only means of external communications.

Present Problems

1. The nursing homes have no means to communicate if telephone service is out. Each nursing home is located near the hospital in the respective communities. The hospital communications could function as a back-up for the nursing homes.

Future Requirements

None.

Additional Comments

1. Both nursing homes have purchased FRS radios for internal use.

2. The fire alarm system is connected to the Sheriff's office in Virginia City by telephone.

The draft of this record was sent to Peter Birkholz on May 3, 2005.

Peter Birkholz, Administrator
Madison County Nursing Homes
P. O. Box 308
Sheridan, MT 59749

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **County Planning Office**

File Name: **Madison County - Planning Dept Interview Record.doc**

Date of Interview: **4/06/05**

Location of Interview: **Virginia City, MT**

Persons Interviewed: **Doris Fischer**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Doris Fischer is the County Planner. She is the unofficial 911 Coordinator for the implementation of Enhanced 911.

2. The county just hired an individual who will service as the Information Technology support staff, Geographic Information, and 911 Coordinator.

Present Situation

1. The Master Street Address Guide (MSAG) is approximately 95% complete. Countywide addressing is approximately 90% complete, except for the Big Sky area. The Big Sky area will be done in about 1 year with Gallatin County managing the Big Sky E911 project..

2. The County Commissioners need to approve the road names then the post office will need to verify and update their records of rural route customer addresses. Once that is completed, address notifications will be sent to all addresses. Finally, the addresses will be integrated with the E911 provider. The County is currently exploring two options, CenturyTel or QWEST. It is anticipated that enhanced 911 will be implemented this fall. Wireless Phase I and II will follow.

3. The CAD vendor will integrate the ANI/ALI information into CAD. Mapping software for dispatch display maybe provided by Bulberry.

4. The County's Geographic Information Systems efforts are described as fledgling. While they have had a GIS system for 7 years, they are just starting to move beyond the basics. They began with parcel mapping. They are doing some mapping. They've done strategic wildland fire mapping and mapped dry hydrants. They have done minimal flood mapping at this point.

Present Problems

1. Madison County is experiencing significant growth. However, since most of the new residences are seasonal this growth is not reflected in population figures. The number of permits for new septic systems is probably the closest indicator of the growth. In 1999, 115 permits were issued. 104 were issued in 2000; 155 in 2001; 115 in 2002; and 130 in 2003. In 2004, the number increased to 214.

Future Requirements

None.

Additional Comments

1. Madison County has a tower ordinance for any tower over 100 feet tall.

The draft of this record was sent to Doris Fischer on May 9, 2005.
Corrected draft was returned to CTA Communications on May 27, 2005.

Doris Fischer
Madison County Planning Office
P.O. Box 278
Virginia City, MT 59755

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Ruby Valley Ambulance Service**
File Name:	**Madison County - Ruby Valley Ambulance Service Interview Record.doc**
Date of Interview:	**4/07/05**
Location of Interview:	**Sheridan, MT**
Persons Interviewed:	**Jane Yecny**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Ruby Valley Ambulance Service is an all–volunteer based in Sheridan.

2. Jane Yecny is the president of the Ambulance Service.

Present Situation

1. The RVAS has 3 units. In 2004, they responded to 159 runs. For the first 3 months of 2005, the have responded to 100 runs, including 7 rollover accidents.

2. The RVAS is dispatched by the Sheriff's Office in Virginia City. In addition, they have paging capability from the base station at their crew hall.

Present Problems

1. Coverage issues, especially in some of the drainages (Mill Creek, Wisconsin Creek, etc.), the west slope of the Tobacco Root Mountains, and areas of the Upper Ruby Valley. Also, there is poor in-building coverage from the new gym in Sheridan.

2. During the day, the RVAS occasionally is short on available responders. Their goal is a 15 minute response (to be enroute to a call).

Future Requirements

1. Mobile computers for map display.

Additional Comments

1. There is concern about the survivability of the dispatch in Virginia City and the lack of a back-up.

2. There is concern about the implementation of the county-wide addressing. Many addresses will change. RVAS personnel have a good knowledge of the area and are concerned that the new (changed) addresses could cause confusion and delayed response.

The draft of this record was sent to Jane Yecny on May 9, 2005.
Corrected draft was returned to CTA Communications on June 17, 2005.

Jane Yecny
Ruby Valley Ambulance Service
P. O. Box 77
Sheridan, MT 59749

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Ruby Valley Hospital**
File Name:	**Madison County - Ruby Valley Hospital Interview Record.doc**
Date of Interview:	**4/05/05**
Location of Interview:	**Sheridan & Twin Bridges, MT**
Persons Interviewed:	**Roman Hendrickson, M.D.** **Tammy Todd-Reid, R.N.**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Ruby Valley Hospital is a 10 bed facility with an emergency room. Normally there is one R.N. and 1 aide on duty.

2. The Hospital is served by two physicians and two physicians' assistants.

Present Situation

1. The on-duty nurse has a pager (just received) that will allow her to receive notification when the ambulance is dispatched. There is a remote for the radio located at the nurse's station, but since the nurse's station may be unattended at times when the nurse is in a patient's room, this will permit the nurse to know when a call has been dispatched.

Present Problems

1. The portables, used by the doctors on call, have limited range. They cannot initiate calls from the handheld. The doctors are unable to communicate with each other, and they are unable to communicate with units on the scene without going through the Sheriff's Office dispatch.

2. There is very spotty communications between the hospital and the ambulance. Problem areas include: Alder to Virginia City; Silver Star; North of Cactus Junction; Beaverhead Rock, in addition to limited coverage in drainages.

3. The equipment is old and of poor quality. The paging for off duty hospital personnel is outdated and has limited coverage.

Future Requirements

None.

Additional Comments

1. They were unaware of the Health Alert Network through the Health Department.

The draft of this record was sent to Roman Hendrickson on May 9, 2005.

Roman Hendrickson, M.D. & Tammy Todd-Reid, R.N.
Ruby Valley Hospital
P. O. Box 338
Sheridan, MT 59749

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Madison County Search & Rescue**
File Name:	**Madison County - Search & Rescue Interview Record.doc**
Date of Interview:	**4/06/05**
Location of Interview:	**Virginia City, MT**
Persons Interviewed:	**Roy Parrett, Chairman, SAR Executive Committee** **Gary Gustin, President, SAR Executive Committee** **Michael Buckles, SAR Training Officer** **David Clark, Madison County Sheriff's Office SAR Coordinator** **David Schenk, Madison County Sheriff** **David Schulz, Madison County Commissioner**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Madison County Search and Rescue (SAR) is a volunteer group under the Sheriff. There are two groups within Madison County Search and Rescue – One based in Ennis and the other in Sheridan. The Ennis group has been in existence for a number of years. The Sheridan group is approximately 1 year old.

2. Dave Clark has been designated by the Sheriff as the Search and Rescue Coordinator.

3. There is a SAR group in Big Sky. They have a portable repeater.

Present Situation

1. There are 35 members of Madison County Search and Rescue. They are activated by means of a telephone call-out.

2. The winter and hunting seasons are the busiest time for SAR activity. There are approximately 10-15 SAR calls a year. Recreational use is increasing which results in increased rescue calls in the forest areas. Back country rescue calls have increased 3 times in the last 4 years.

3. The SAR group has purchased several Garmin Family Radio Service (FRS) radios with integrated GPS for $300 each. There are no amateur radio repeaters in Madison County.

Present Problems

1. The SAR group has no pagers. In addition there is very poor cellular coverage. As a result, often times on a call-out, only 3 or 4 members can be contacted. There have been several incidents where there have been problems with SAR cancellations.

2. The Sheridan SAR group has no radios. Most of the Ennis group's radios are older. The Ennis group has purchased 4 new radios. The newer radios have lower transmit output power which limits their range and effectiveness.

3. There is not a separate channel for Madison County SAR.

4. The Madison County SAR has no direct communication with the US Forest Service. Many of the SAR calls occur on Forest Service controlled lands. They especially need a means to communicate with aircraft involved in SAR efforts.

5. Poor cell coverage is an issue for SAR calls, not just for alerting of team members.

6. Neither SAR base has a base station radio.

Future Requirements

1. The Madison County SAR needs at least 20 radios.

Additional Comments

1. The USFS Lazyman repeater provides good coverage in areas where searches frequently occur. The Lazyman repeater is located in the center of the Gravelly Range and provides coverage throughout the Gravellys, northern Centennial Valley and the Upper Ruby Valley.

2. Sheriff Schenk has set up Dave Clark's vehicle to function as an initial command post. Roy Parrett has a motor home that can be used as a command post.

3. Michael Buckles has purchased his own radio. It is an older model GE radio. It works very well, but it is difficult to find someone to program it. He also has an external antenna that can be set up on a tripod to provide improved communications.

The draft of this record was sent to Frank Ford on May 9, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **US Forest Service/Beaverhead-Deer lodge NF**

File Name: **Madison County - USFS-Beaverhead-Deerlodge NF Interview Record.doc**

Date of Interview: **4/07/05**

Location of Interview: **Sheridan MT**

Persons Interviewed: **Ernie Gilbert**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Beaverhead-Deerlodge National Forest is the largest of the national forests in Montana covers 3.32 million acres, and lies in eight Southwest Montana counties (Granite, Powell, Jefferson, Deer Lodge, Silver Bow, Madison, Gallatin and Beaverhead). Over 692,000 acres of the forest are in Madison County. Forest Service offices administering the National Forest are in Butte, Dillon, Philipsburg, Deer Lodge, Whitehall, Boulder, Ennis, Sheridan, Wise River, Wisdom, and Lima.

2. There is a regional interagency dispatch center in Dillon that dispatches both federal (USFS & BLM) and state (DNRC) fire suppression resources.

<u>Present Situation</u>

1. The USFS has several transmitter sites in Madison County. They have been adding sites and trying to improved coverage. They may be willing to share sites.

2. The USFS has several contract fixed wing aircraft based in Dillon, Butte, and other locations. The aircraft are used for fire detection and simlar purposes. The USFS pays for the aircraft based on usage.

3. The USFS Beaverhead-Deerlodge National Forest is completing the transition to narrowband operations this year. The USFS is testing digital mode communications.

Present Problems

1. While coverage has improved, there are still areas with little or no coverage. There may be a decrease in coverage with the conversion to narrowband.

2. Forest Service Rangers are not able to contact the Madison County Dispatch in a large portion of the area. While they can contact the USFS dispatch in Dillon, the USFS dispatch does not have the ability to run wanted and license checks.

3. Bugs are still expected to occur with communications. The USFS has switched to narrowband operation. The full effects from this switch are still unknown, however. There are indications that there may be some reduction in coverage from the wideband mode.

4. The full effects on the interoperability between wideband and narrowband radios are unknown. At this point, they are unsure if problems may surface if they are trying to use their narrowband radios to communicate with wideband radios. Ernie has heard that there may be volume issues.

5. While the USFS has the ability to purchase radio equipment to meet their needs, the small, rural counties may not have that same ability.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Frank Ford on May 9, 2005.
Corrected draft was returned to CTA Communications on May 31, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Virginia City Fire Department**

File Name: **Madison County - Virginia City Fire Interview Record.doc**

Date of Interview: **4/07/05**

Location of Interview: **Virginia City, MT**

Persons Interviewed: **Steve Orr**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Virginia City Fire Department is a city fire department. It does not have any responsibility beyond the city limits of Virginia City and Nevada City. The department does respond outside the city limits on a mutual aid basis.

Present Situation

1. Because the Virginia City tower is in the immediate proximity to the department coverage area, they have no coverage issues.

2. The department has 4 structure fire fighting engines, 2 water tenders, 2 wildland fire units and a medical Quick Response Unit (QRU).

3. The department has a10-20 person roster.

Present Problems

1. Improved communications training is needed. There is a wide variance in training and proficiency.

Future Requirements

1. Additional portables are needed.

Additional Comments

None.

The draft of this record was sent to Frank Ford on May 9, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **West Madison County Fire Agencies**

File Name: **Madison County - West County Fire Interview Record.doc**

Date of Interview: **4/05/05**

Location of Interview: **Sheridan, MT**

Persons Interviewed: **Kelly Elser, Sheridan Fire Dept**
Craig Ballon, Twin Bridges Fire Department
Steve Gilman, Alder Fire Department

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Three departments cover the Ruby Valley and Jefferson Valley portions of Madison County.

Present Situation

1. The fire departments are dispatched on the single channel used by all public safety agencies in the county.

2. The Sheriff's Office uses the base station in Virginia City to dispatch the departments in the Ruby Valley area (Alder. Sheridan, Twin Bridges).

3. There are two other base stations in the Ruby Valley (Upper Ruby or Baldy) and lower Ruby. Both of those base stations are repeaters.

Present Problems

1. Coverage is poor for both radios and pagers in a number of areas in the Ruby and Jefferson Valley. Areas of poor coverage have been indicated on maps provided to CTA.

2. Procedures call for Dispatch to use the Baldy repeater to dispatch the fire departments in the Ruby Valley. Dispatch sometime forgets too use that. As a result some personnel don't receive the pages.

3. The area has been experiencing a large influx of seasonal residents. This accentuates the urban/rural interface issues. As people build in obscure spots, the communications problems increase.

4. The lack of dispatch capability is an issue. The encoder is at maximum capacity. New channels can't be added to the consoles. Communications gets overloaded during a large incident.

5. Training in using proper radio procedures is needed.

6. Dispatch can't dispatch if power is lost in Virginia City.

7. The Alder Fire Department has no base station at the fire station.

Future Requirements

1. Portables are needed for responders who live a distance from the fire station.

2. A number of ranchers have their own private fire equipment. There is a need to figure out how to integrate that into the system. A cache of portables to be distributed as needed might be an answer.

Additional Comments

1. There is concern about a potential catastrophic failure of the Ruby Reservoir. There is a need for a warning system.

2. The State of Montana offers volunteer fire fighters with 20 years of service at age 50 a pension. To be eligible for the pension the fire fighter must complete 30 hours of training during the year, be signed off by the Fire Chief as a member, and have participated with the volunteer fire company for the full year, July 1 to June 30th the following calendar year. Volunteer fire companies are limited to 28 members per company, and 1 company per thousand population is protected.

The draft of this record was sent to Frank Ford on May 9, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Madison County LEPC Communications Subcommittee**

File Name: **Madison County LEPC Interview Record.doc**

Date of Interview: **4/07/05**

Location of Interview: **Virginia City, MT**

Persons Interviewed: **Scott McClintic**
Dan Birdsill
Frank Ford

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Local Emergency Planning Commission (LEPC) assists with the emergency planning and preparedness efforts in Madison County.

2. The LEPC Communications Subcommittee is focused on communications.

Present Situation

1. The Norris site is in good shape It is a shared site, owned by Montana Power.

2. The Virginia City site is in poor condition. There is no emergency power. The building is in poor condition. There is no grounding or lightning. A cattle company may be sharing the site. There are no written agreements for the tower. Road access is an issue.

3. The Baldy site is shared with the Montana Highway Patrol and the Bureau of Land Management. It is in good shape.

4. The Ruby site is in a “job box” that has been painted camouflage. It is in a buffalo pasture on a ranch owned by Ted Turner.

Present Problems

1. Much of the equipment is old. Insufficient attention has been paid to the sites.

2. There is no communications with Big Sky or with adjacent Idaho agencies.

3. Many potentially significant areas of the county lack adequate radio coverage.

Future Requirements

None.

Additional Comments

Much of the portable and mobile communications equipment as “hand me down” obtained as surplus from other (mostly federal) agencies.

The draft of this record was sent to Frank Ford on May 9, 2005.
Corrected draft was returned to CTA Communications on May 27, 2005.

M:\FILES\20077 SCMIC\interview\Madison County\FINAL\Madison County LEPC Interview Record.doc

CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Madison County Sheriff's Department**
File Name:	**Madison County Sheriff's Dept Interview Record.doc**
Date of Interview:	**4/06/05**
Location of Interview:	**Virginia City, MT**
Persons Interviewed:	**Dave Schenk, Sheriff** **Roger Thompson, Undersheriff** **Steve Orr, Captain**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Madison County Sheriff's Department is the primary law enforcement agency for most of Madison County. The department has 9 sworn employees: Sheriff, Undersheriff, Captain and 5 deputies. There is a Constable in Ennis, and the county is also served by the Montana Highway Patrol.

2. The Sheriff serves as the search and rescue coordinator.

3. The Sheriff's Office answers 911 calls and provides dispatch for all Madison County agencies.

<u>Present Situation</u>

1. The Sheriff's Department operates 4 different transmitter sites. All sites have a common output frequency (155.025 MHz). The Virginia City transmitter is a simplex base on 155.025. The other three sites are repeaters. They use the same input frequency (153.935).

2. The Sheriff had been using a Bureau of Land Management site on Mauer Mountain that they were forced to vacate due to interference issues. After they vacated the site, it was found the interference was coming from elsewhere.

3. The upper portion of the Big Sky Ski Resort is in Madison County. Yellowstone Club and Moonlight Basin are two new developments in the same area in Madison County. Madison County may be adding 3 deputies to cover Madison County. Currently, there is no communications with the Big Sky area.

Present Problems

1. The Baldy and Ruby repeaters are using the same tone coded squelch frequencies. As a result, they interfere with each other.

2. Numerous dead spots. Maps were provided to CTA showing the problem areas. There are 10 miles of Interstate 5 in Madison County with no radio coverage.

3. Insufficient attention has been paid to the condition of the sites. The equipment is old. The equipment and facilities at dispatch are inadequate. There is a lack of capacity on the paging encoder. The equipment being used is low power. The mobiles vary from 30 Watts output to 110. The portables come from various manufacturers.

4. Madison County is receiving interference from Meagher County DES on the Sheriff's tactical channel.

5. The Sheriff's Office, fire departments and ambulance services all use the same channel. It would be better if there were more channels.

6. Some single frequency repeaters have been added to improve pager coverage. These create feedback issues.

7. There is no interoperability with Idaho law enforcement units. Madison County borders Idaho.

8. There is no back up for the dispatch center. There is no emergency power for the Virginia City transmitter site. If that site is down, there is no way to communicate with the other repeaters.

9. There is no encryption available. As a result, there are significant privacy concerns.

Future Requirements

None.

Additional Comments

1. A new CAD system was recently implemented. For the first three months of 2005, the Sheriff's Department has handled 1,436 complaints. Last year, the department handled 2,872 complaints for the entire year.

2. Madison County just received a portable repeater. It is not linked to dispatch.

The draft of this record was sent to Frank Ford on May 9, 2005.

M:\FILES\20077 SCMIC\interview\Madison County\FINAL\Madison County Sheriff's Dept Interview Record.doc

CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Meagher County Sheriff, Fire, EMS, Public Works**
File Name:	**Meagher County - Sheriff Fire PW Interview Record.doc**
Date of Interview:	**4/08/05**
Location of Interview:	**Meagher County Fire Training Room**
Persons Interviewed:	**Rick Seidlitz, Sheriff/Coroner** **Forrest Tellock, Search and Rescue** **Ray Ringer, Supervisor - County Roads** **Jack Berg, County - Health** **Otto Ohlson, Fire Chief**
CTA Interviewer:	**Nate McClure** **David Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Sheriff operates two, 12 hour shifts with one person on patrol per shift. Three deputies are currently on staff. County population triples in the summer with tourists and outdoor recreation.

2. Two different fire departments exist on paper in White Sulphur Springs, but in reality, many of the same personnel serve more than one department.

3. Dispatch for all county functions is handled out of the Sheriff's office.

<u>Present Situation</u>

1. Dispatch has radio or control station access to these channels:
   Sheriff's repeater – Sheriff Office

DES repeater - used by everyone except Sheriff including school buses, roads, rural fire
Rural Fire repeater
Martinsdale (Fire)
Mutual Aid Gold
EMS White
EMS Grey
EMS Pink – State EMS
Several direct (simplex) channels are in use, one the same frequency as the DES repeated channel.

2. The County has two repeater sites:
Porphyry Peak (Kings Hill): DES repeater, Sheriff repeater
Martinsdale: Rural Fire repeater

They are adding two additional sites.

3. About 60 – 100 tone/voice pagers are in use by all departments in the County. The paging terminal is at dispatch, the base is at the Kings Hill site, and the paging frequency is the same as the DES direct channel.

<u>Present Problems</u>

1. County Roads needs to talk to State Roads, but state personnel no longer have the DES channel programmed in their radios.

2. Several coverage problem areas were discussed. We received several marked up maps that will be used in the coverage study.

3. The hospital can only talk to ambulances within about 7 miles over a direct channel. The hospital system has the poorest coverage of all of the systems in the County. They are now relaying patient information over the Sheriff's channel.

4. Dead spots for paging coverage exist countywide. Again we received marked maps showing these locations.

5. Search and rescue is increasingly a rescue operation only with locations called in via cell phone. Cell phones do however, give misleading locations. In addition, cell phone coverage is poor. Meagher County also receives cell phone calls from outside of the County.

Future Requirements

1. Repeated wide area hospital channel and school bus channel.

2. Repeated EMS channel.

The draft of this record was sent to Rick Seidlitz on May 9, 2005.

Meagher County Sheriff
Rick Seidlitz
P.O. Box 449
White Sulphur Springs, MT 59645

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Bridger Communications**
File Name:	**Park County - Bridger Communications Interview Record Draft.doc**
Date of Interview:	**3/31/05**
Location of Interview:	**Bridger Communications**
Persons Interviewed:	**Jeff Tong**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Bridger Communications is a radio service shop that services clients in Gallatin, Park, Madison, Sweet Grass, and Meagher Counties.

2. Jeff Tong is the owner of Bridger Communications. He is also a member of the Fort Ellis Fire Department.

Present Situation

1. Bridger Communications services most of the radios in Park County.

2. Bridger Communications handles approximately 70-80% of the radios in Madison County.

3. Bridger services some of the mobiles in Meagher and Sweet Grass Counties.

Present Problems

1. Most of the radio sites are substandard in terms of condition, grounding and so forth.

2. Much of the mobile and portable equipment is older.

3. Bozeman Dispatch uses 4 different fire channels.

Future Requirements

None.

Additional Comments

1. Bridger has a possible site on Electric Peak near Yankee Jim Canyon in Park County.

The draft of this record was sent to Frank Smith on April 25, 2005.

M:\FILES\20077 SCMIC\interview\Park County\FINAL\Park County - Bridger Communications Interview Record Draft.doc

CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Livingston/Park County Dispatch**

File Name: **Park County - Dispatch Interview Record.doc**

Date of Interview: **3/30/05**

Location of Interview: **Livingston City Hall/Park County Building**

Persons Interviewed: **Peggy Glass**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. 911/Communications is a separate department of the City of Livingston.

2. The dispatch center serves both the City of Livingston and Park County.

3. In addition to the communications function, the dispatch staff also provides clerical support to both the Livingston Police Department and the Park County Sheriff's Department. These duties include: processing fingerprint cards; entering court dispositions in records; maintaining arrest records/docket books; transcribing interview tapes; compiling monthly and yearly statistical reports; making copies of tapes for served entities; receiving city arrest bonds; recording city accident reports; recording rural fire burn permits; providing secretarial support for served entities; answering the court house switch board; preparing reports for City Court trials; dispersing of reports to City and County Attorneys, Social Services, etc; releasing reports to private citizens; warrant entry; assuring that officers complete field reports; assuring that supervisory review occurs; issuance of parking permits; issuance of transient vouchers; key control for building; release of vehicle impounds; run pawn slips; process concealed weapons permits; close out evidence and investigation files.

4. Peggy Glass is the Dispatch Coordinator/Department Head.

Present Situation

1. The dispatch center is equipped with two full positions. In 2005, new Watson workstation furniture was installed. New Zetron radio consoles were installed in February, 2005. New Zetron 911 CPE was being installed at the time of this interview. A new generator and UPS were also being installed at the same time. In addition, as part of the same project, the grounding was being upgraded to R56 standard.

2. The dispatch center answers 911 calls for the entire county, except the Gardiner and Cooke City areas. 911 calls from those areas are answered by the Yellowstone Park Dispatch Center at Mammoth Hot Springs, WY. The Livingston Dispatch Center provides wireline enhanced 911 services. They currently provide wireless Phase 0 service and are in the process of deploying Phase I. They plan to complete Phase I and II deployment by the end of the year. There are currently 4 incoming 911 trunks and 6 other lines in dispatch. Emergency Medical pre-arrival instructions are provided using material approved by the County's Medical Control Authority. In addition to serving the law enforcement, fire and EMS agencies, they provide after-hours dispatch for Park Electric Company.

3. The dispatch center currently has 6 telecommunicators and the Dispatch Coordinator. One or two telecommunicators are on duty at any one time. The staff works 8 hour shifts. New telecommunicators must complete 40 hour basic training at the Montana Public Safety Academy. They must also complete on-line training on CJIN/NCIC operations and 16 hours of records training.

4. The center is busiest in the summer, but activity levels for other seasons are increasing.

5. The dispatch center has a Sleuth Computer Aided Dispatch System. The system is approximately 4 years old. It is not interfaced with the 911 system. There is no redundant processor. The system does not provide unit recommendations or fire run cards. It provides limited management reporting. The basic purpose of the system is incident based reporting. The dispatch center is preparing to replace the CAD system.

Present Problems

1. The dispatch center is space limited. Not only is this a problem in the operations area, but there is also a lack of room for the electronics and other necessary equipment. There is a need for a second terminal on the state Criminal Justice Information Network.

2. Radio coverage is a major issue. The area south of Emigrant/Point of Rocks; the Springdale area and the area north of Clyde Park were all identified as problem areas.

3. There is a lack of unified dispatch and radio procedures, especially with the various fire departments. Each agency wants things done a different way.

4. There is no direct communication with the Yellowstone National Park dispatch. When YNP receives a call that needs to be handled by Park County, YNP writes the information out longhand and then faxes the information to Park County.

5. The dispatch center lacks the ability to page multiple agencies at the same time. As a result, often times a dispatch must be repeated 4 different times.

6. There are no back-up facilities for the dispatch center. The dispatch center is located less than ¼ mile from the main line of the Burlington Northern/Santa Fe and Montana Rail Link. There is also a rail yard at the same location. Numerous placarded rail cars were observed in transit during our visit to Livingston. Derailments have occurred in the area close to the center. There are some limited facilities at Park County Rural Fire Station One, but that station is even closer to the railroad tracks.

Future Requirements

1. Single button paging.

2. Improved coverage, including repeaters.

3. Text messaging.

4. Mobile Data Terminals.

Additional Comments

None.

The draft of this record was sent to Frank Smith on April 25, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Park County Road Department** **Livingston Department of Public Works**
File Name:	**Park County - DPW & Road Dept Interview Record.doc**
Date of Interview:	**03/28/05**
Location of Interview:	**Livingston City Hall/Park County Courthouse**
Persons Interviewed:	**David I Bronz, Park County Road Dept.** **Tom Schwigert, City of Livingston Department of Public Works** **Frank Smith Park County Homeland Security Director**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The Park County Road Department is responsible for the County Roads and Bridges. They are responsible for 1100 miles of road. The County maintains County Roads even in the City.

2. The Livingston DPW is responsible for water and sewer hook-ups, street maintenance, and garbage removal.

3. The Montana Department of Transportation maintains State roads even in the City.

<u>Present Situation</u>

1. Both the Park County Road Department and the Livingston DPW have their own radio channels. They monitor each others channels.

2. Both Departments have access to three different mutual aid channels (Gold, Black, & Blue).

3. The Road Department is using a mobile radio as a base station with little or no grounding.

4. The City of Livingston DPW is using a Kenwood Mobile as the base station.

5. The DPW has telemetry installed on approximately one-half of their water and sewer facilities.

6. Major flooding was experienced along the Yellowstone River in both 1996 and 1997.

7. Significant growth is being experienced in both the City and the County.

Present Problems

1. The Road Department's Radio License expired in 2002. The frequency has been reassigned by the FCC to another user. The County is in the process of trying to obtain a new frequency and license. Until that happens, they are using the Gold Mutual Aid channel.

2. The County Road Dept has some coverage problems, particularly in the West Boulder, Yankee Jim Canyon, and Cooke City

3. Much of the equipment being used is older, some dating from the 1970's.

4. Not all vehicles are radio equipped.

Future Requirements

1. It is expected that significant growth will occur in the near future. The City of Livingston currently has approximately 3,400 residential water services. They have been told to expect an additional 2,000 in the next several years. 40-50 new homes per year have been built in the past. Now more than 100 are being constructed.

2. Park County is anticipating significant growth as well. It is anticipated that the county will see a 50% growth in the next two years.

Additional Comments

None.

The draft of this record was sent to Frank Smith on April 25, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Park County EMS/Hospital**
File Name:	**Park County - EMS Interview Record.doc**
Date of Interview:	**3/30/05**
Location of Interview:	**Park County Building/Livingston City Hall**
Persons Interviewed:	**Jan Gaertner, Cooke City, MT** **Jim Mastin, Chief Livingston Fire/Rescue** **Doug Dunn, Comm Tech** **Bill Bryce, Livingston Health Care** **Frank Smith, Park County Homeland Security Coordinator.**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Jan Gaernter is the only Montana certified Medical First Responder in Cooke City.

2. Jim Mastin is the Chief of the City of Livingston Fire/Rescue Department. The department is one of the three agencies that provide EMS transport in the county.

3. Bill Bryce is the Bio-Med Technician at the Livingston Health Care Center.

4. Doug Dunn has a communications business. He is retired from QWEST. He is also involved in search and rescue.

Present Situation

1. Three agencies provide EMS transport service in the County. They are Livingston Fire/Rescue (4 vehicles/ALS), Paradise Valley (1 vehicle/partial ALS); and Gardiner (1 vehicle/ upgrading to intermediate). In addition, the National Park Service responds from Yellowstone Park, if they are available, to Cooke City and the Gardiner area.

2. The Livingston Health Care operates a 15-20 bed hospital. The Emergency Room is not staffed 24 hours a day. When there is no one on-duty at the ER, the EMS radio is monitored at the med-surg nurses' station. The hospital is pursuing a Level 4 Trauma Center designation. They anticipate building a new hospital in the next 3-5 years.

3. Cooke City has 75 full-time residents. During the summer, there are about 300 residents. Jan Gaertner is the only certified first responder in Cooke City year round. During the summer, there is a retired couple who assist her. The National Park Service usually has an ambulance stationed at the Northeast Gate to Yellowstone National Park. The closest hospital is 76 miles away in Cody, Wyoming. During the winter, the road is closed between Cooke City and Cody. The Livingston Hospital is 110 miles from Cooke City. In the summer, the calls received are more medical related while in the winter, the calls are more trauma related.

4. The hospitals in Billings and Bozeman are both designated as Level II Trauma Centers. The closest Level I Trauma Centers are in Denver, Colorado, Salt Lake City, and Spokane, Washington. Helicopter transport is available from Billings or Idaho Fall, ID.

5. Funding for EMS comes from separate millage levies for EMS by both the County and the City of Livingston. In addition, Livingston and Paradise Valley is fee for service operations. Gardiner is in the process of implementing fee for service.

6. Livingston Fire/Rescue responds to approximately 200 medicals a year. Their primary response area is the City of Livingston and everything north of the City. In addition, south of the City, there is a dual response with Paradise Valley. Gardiner Ambulance responds to approximately 50-60 calls per year. More than half of the calls Gardiner responds to are for non-residents. Livingston Fire makes approximately 5-6 responses to Gardiner each year. Livingston Fire/Rescue has one ambulance staffed per shift. Additional staffing is obtained through call-backs of off-duty personnel. The Livingston Fire/Rescue Department is staffed by career personnel. The remaining agencies are all volunteer.

7. Medical communications are conducted on the State EMS channel (155.280 MHz). The primary base station is located on North Hill. There is a back-up base at the hospital. Alerting of EMS responders is done on the fire dispatch channel, except of Gardiner and Cooke City. These two communities are dispatched by the Yellowstone National Park Dispatch.

Present Problems

1. Radio coverage is the major issues. The problem areas are the same as with the fire service, law enforcement, and others.

2. EMS responders have an especially difficult time communicating from the patient's side. The UHF "Med" channels are not used. It is difficult to communicate with the hospital from several locations in the county.

3. Livingston Fire/Rescue has recently upgraded to Advanced Life Support. Communications with the doctors is challenging as is interaction with other services.

4. The current and anticipated growth is another challenge facing the EMS community.

5. The EMS channel is not recorded. It is not monitored in dispatch.

6. Dispatch Center cannot multiple agencies concurrently.

Future Requirements

1. Improved coverage.

2. Improved communications with hospital and other agencies.

3. Increased Funding.

Additional Comments

None.

The draft of this record was sent to Frank Smith on April 25, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Park County Fire Council**

File Name: **Park County - Fire Council Interview Record.doc**

Date of Interview: **3/28/05**

Location of Interview: **Park County Rural Fire District #1**

Persons Interviewed: **See List**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. There are 8 Fire Departments in Park County (Livingston Fire, Park County Rural, Paradise Valley, Clyde Park City, Clyde Park Rural, Wilsall, Gateway Hose Company, and Cooke City).

2. There are 3 agencies that provide EMS transport in Park County (Livingston Fire & Rescue, Paradise Valley Fire & Ambulance, and Gardiner Ambulance).

3. A significant portion of Park County is in the Gallatin National Forest. The southern portion of Park County is in Yellowstone National Park. Park County is 140 miles long (north to south).

Present Situation

1. The Cooke City Fire Department, Gateway Hose Company, and Gardiner Ambulance are dispatched by the National Park Service, Yellowstone Park Dispatch Center. These departments primarily communicate on National Park Service channels.

The Cooke City Fire Department has no mobile or portable radios. 2 mobiles and 2 portables have been obtained for the Cooke City FD through a DHS grant and will be installed shortly.

2. Livingston Fire Rescue is dispatched on its own channel. The remaining departments (Park County Rural, Paradise Valley, Clyde Park City & Rural, and Wilsall) a common channel. Livingston Fire has a single site. There are two repeaters on the channel. Both repeaters transmit and receive on the same frequency pair, but use different continuous tone coded sub-audible squelch frequencies (CTCSS).

3. Park County Fire Departments have frequent interaction with both the National Park Service at Yellowstone Park and the U.S. Forest Service. Both agencies have converted to narrowband.

4. In 1990, the State of Montana developed a Mutual Aid and Common Frequency Plan. This plan provides 19 different channels for either mutual aid or common use throughout the state. Six of the mutual aid channels are designated for fire service use. Most of the mobiles and portables used by the Park County Fire Departments are multi-channel and have been programmed to permit access to many of the statewide mutual aid channels.

5. Except for Cooke City, the fire departments are dispatched by tone and voice pagers. Cooke City FD is dispatch by the Park Service making telephone calls to the list of firefighters.

Present Problems

1. There is very limited, if any, communications between units or stations north of Yankee Jim Canyon and those units south of the Canyon.

2. There are coverage issues in a number of areas in the county (Yankee Jim Canyon, West Boulder, etc.) The coverage issue for pager activation is more widespread. Coverage problem areas were indicated on a map.

3. The Paradise Valley FD can't communicate with the Sheriff's Office directly, even when they are responding to the same incident.

4. Interference is being received on the Livingston Fire/Rescue Channel. This interference is coming from the new Lewis and Clark system.

It is believed that the control channel is using the same frequency (154.340 MHz.). Interference is also being received in the vicinity of some commercial facilities that have a large amount of computer equipment.

5. Coordination with other counties at times can be challenging.

6. Because there is currently no law enforcement repeater, the law enforcement agencies are using the fire repeaters for car-to-car communications. This sometimes interferes with fire communications.

7. There is no handheld coverage in the south end of the county.

8. Currently there are no back-up facilities for dispatch.

Future Requirements

1. Significant population growth is anticipated in the near future. Much of this growth will be in Livingston.

2. Cooke City needs to be able to communicate with the Forest Service since much of the land surrounding Cooke City is in the National Forest or Wilderness area.

3. There is a need for improved procedures and training on those procedures.

Additional Comments

1. Generally the departments have the ability to talk to each other; it is more a frequency management issue.

2. In a major incident, Incident Command has too many channels to monitor.

3. In wild land fires, the Park County Fire Departments generally have responsibility for structure protection. State and Federal agencies have responsibility for fighting the wild land fire.

The draft of this record was sent to Frank Smith on April 25, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Park County Law Enforcement**
File Name:	**Park County - Law Enforcement Interview Record.doc**
Date of Interview:	**3/29/05**
Location of Interview:	**Park County Courthouse/Livingston City Hall**
Persons Interviewed:	**Peggy Glass, 911 Director** **Darren Raney, Chief, Livingston Police Dept** **Clark Carpenter, Sheriff, Park County** **Gary Tanascu, Undersheriff, Park County, MT**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The Livingston Police Department provides primary law enforcement service for the City of Livingston. Darren Raney is the Chief of Police.

2. The Park County Sheriff's Office provides primary law enforcement service for Park County. Clark Carpenter is the Sheriff.

3. The Montana Highway Patrol has approximately 200 troopers statewide. They have limited authority. They are primarily traffic patrol. Because there are only about 35 troopers on duty at any one time statewide, the MHP has relatively little presence in Park County.

4. The National Park Service has primary law enforcement responsibility for Yellowstone National Park.

Present Situation

1. The Park County Sheriff's Office has limited resources with very limited communications. Lack of adequate manpower is a major issue. Generally, there are only one or two officers on duty at any given time. Park County consists of 2,626 square miles.

2. The Livingston Police Department has equipment and manpower issues. There are generally two patrol units on duty in Livingston around the clock.

3. The Sheriff is responsible for Search and Rescue. There are approximately 50 search and rescue calls in Park County each year. During the winter recreation season, they are averaging 2-3 SAR calls pre week in the Cooke City area. The area above Cooke City has major avalanche issues. There are frequent calls in the summer involving 4 wheel drive vehicles. In much of the area with the searches occur, there is even more limited communications. Park County does have a portable repeater for SAR operations. There are also incidents involving float boats on the Yellowstone River. With the increased use of GPS, there are more rescue calls than searches.

4. Both the North and Northeast entrances to Yellowstone National Park are in Park County. Approximately 750,000 of the 2,900,000 visitors to the park each year use one of those entrances. Currently, during the winter, the only way to get to Cooke City by wheeled vehicle is by entering the park at the north entrance (Gardiner) and then driving approximately 52 miles through the park and exiting the park at the northeast entrance. Currently, the Coulter Pass is not plowed. There is discussion about keeping the pass open during the winter beginning in the next several years. This will result in increased traffic in the winter. During the summer season, all of the available lodging, recreational vehicle, and camping spots in the park fill up every day. Much of the overflow comes into Park County and creates major traffic problems.

Present Problems

1. There is a lack of radio coverage in a number of areas in the County. Among these areas are: Yankee Jim Canyon, the area south of Yankee Jim Canyon, Main Boulder, West Boulder, Tom Miner Basin, the Smith Creek Drainage and north of Wilsall. Both the Main Boulder and the West Boulder have numerous church camps and lots of activity during the summer. There is some coverage using the Sweet Grass County south repeater.

2. Livingston PD portables cannot communicate effectively in some areas. Portable to portable communications between officers is limited. Additionally, officers in vehicles cannot always receive transmissions for officers using portables.

3. Currently, the Park County Sheriff's Office does not have any means of communication with Cooke City other than through the National Park Service. The Park Rangers back up the Sheriff's Office in the south end of the County. There are concerns about units being able to communicate.

4. The Park County Sheriff's Office repeater was forced to be taken out of service due to the loss of access to the site it was at. They are currently trying to find another site. The lack of a repeater has limited communications. As a result, the Sheriff's Office ends up using the Park County Rural Fire repeaters. This creates problems.

Future Requirements

1. Improved communications with south end of the County, especially from mobile units.

2. Improved portable to portable communications

3. Improved coverage all areas and reinstallation of repeater.

Additional Comments

1. Mobile Data would be nice, but it is not a high priority.

The draft of this record was sent to Frank Smith on April 25, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Yellowstone National Park Dispatch**

File Name: **Park County - Yellowstone National Park Dispatch Interview Record.doc**

Date of Interview: **3/29/05**

Location of Interview: **Mammoth Hot Springs, WY**

Persons Interviewed: **Kaelyn Johnson**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. The NPS operates a 24 hour dispatch center at Yellowstone National Park Headquarters in Mammoth Hot Springs, WY.

2. The YNP dispatch center serves as the 911 answering point for most of the park as well as for the Gardiner and Cooke City areas in Park County, MT.

3. The West Yellowstone, MT PD answers 911 calls for the area around the west entrance to YNP.

Present Situation

1. The center recently upgraded to Watson workstation furniture and Orbacom CRT consoles. There are a total of 8 positions with 6 positions fully equipped. 4 of the positions are equipped with NCIC terminals.

2. The YNP Dispatch Center provides Basic 911. There are efforts to upgrade to Enhanced 911 in at least the Montana portion of the area served.

3. Phase 0 Wireless 911 is provided. Approximately 80% of the developed area of the park has CMRS coverage.

4. The dispatch center receives approximately 30-40 calls for service per week during the off season. During the peak season that number more than doubles.

5. NPS emergency vehicles have been equipped with satellite phones.

6. Yellowstone National Park has its own structural fire department. They have 8 stations. Not all stations are operational year round. There is a paid fire chief. All of the rest of the fire fighters are volunteers.

<u>Present Problems</u>

1. There is no direct communication between the YNP Dispatch and Park County Dispatch. They must either use the telephone or fax. Usually, the YNP Dispatchers write the call out in longhand and fax it to Park County Dispatch.

2. YNP Dispatch does not have a Computer Aided Dispatch System (CAD). The National Park Service is implementing an Incident Management and Reporting System (IMARS) for the park service. Evaluation of qualified proposals is anticipated to begin in March, with potential contract award in the spring of 2005. Subsequent to award and system configuration, the NPS pilot program is scheduled for testing in the summer of 2005 at Everglades, Lake Mead, Organ Pipe, Ozarks and Yosemite and by the US Park Police (Washington DC). As a result, YNP Dispatch is prohibited from obtaining a CAD system.

3. Cooke City is very isolated. There are no law enforcement officers there on a regular basis. There is only one medical first responder, the fire department has no mobile or portable radios, and communications is extremely limited.

4. A portion of Highway 191 which runs from Bozeman to West Yellowstone goes through Yellowstone National Park. Montana Highway Patrol radio system coverage is limited in that area. As a result MHP troopers use the NPS dispatch about 30 times a week.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Frank Smith on April 25, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **National Park Service – Yellowstone National Park**

File Name: **Park County - Yellowstone National Park Radio Interview Record.doc**

Date of Interview: **3/29/05**

Location of Interview: **YNP Headquarters, Mammoth Hot Springs, WY**

Persons Interviewed: **Trent Coppinger, NPS Radio Technician**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Yellowstone National Park consists of 3,472 sq miles. A portion of the park is in Park County Montana, including the North and Northeast Entrances. A portion of the park is in Gallatin County, Montana, including the West Entrance. Over 2,000,000 visitors enter the park each year.

2. Only the North and Northeast entrance to the park remain open in the winter. Approximately 140,000 people visit the park in the winter.

3. YNP has a staff of radio technicians. Trent is one of the radio technicians.

Present Situation

1. The NPS operates 3 primary repeater systems in the Park (North, South, and West). Each of the systems has multiple repeaters on the system. Each repeater in a system uses the same transmit and receive frequencies, but different CTCSS tones.

2. There is also a separate Scene of Action (SOA) System. There are 3 SOA repeaters, each with a distinct CTCSS.

3. There is a separate channel for wild land fire operations.

4. The NPS is in the process of converting all the radios at YNP to narrowband analog. There are no plans at this time to convert to digital at this time.

Present Problems

None.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Frank Smith on April 25, 2005.

Frank E. Smith, Jr.
414 E. Callender
Livingston, MT 59047

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Sweet Grass EMS**

File Name: **Sweet Grass - EMS Interview Record.doc**

Date of Interview: **4/05/05**

Location of Interview: **300 N. Willson Ave Suite 502 E, Bozeman, MT 59715**

Persons Interviewed: **Joe Hansen, Executive Director, Critical Illness and Trauma Foundation**

CTA Interviewer: **David Anderson**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. Dr. Hansen requested a meeting with the CTA engineer to share details of the Sweet Grass County infrastructure and to answer questions. Below is summary of the notes made during this discussion.

<u>Present Situation</u>

1. Tin Can Hill Site:
   - AMSL: 4850’
   - 30 M Tower (apparently Rohn 45G from the photos)
   - Local Government repeater and Sheriff repeater
     - Both are new Quantars
     - 12 hour battery backup
     - 4 wire lines to dispatch
     - Muxed (duplexed) into two antennas along with MHP repeater
   - DOT repeater – with batteries, not muxed into the above antennas
   - National Public Radio transmitter with batteries
   - Expansion space available in the shelter, but no room on the tower

2. Airport Site:
    - EMS radio using GE MII or MIII
        - Also serves as the paging transmitter
        - 18' VHF antenna located on the 40' airport beacon tower
    - Macom MIII controls the "Monument Peak" repeater (usage unknown)

3. Monument Peak Site:
    - Equipped with a low power Daniels transceiver (usage unknown)

4. Big Timber Site (Sheriff's Office):
    - Three M/A-COM MIIIs are muxed onto 3 antennas
        - Repeated channels are Sheriff's Office 1 and Local Government 1
        - Local Government 2 is a talk around channel
    - One Zetron paging terminal is controlled from the Courthouse
    - Two other Zetron paging terminals are controlled from the hospital

Present Problems

1. Reliable coverage up the I90 corridor near Greycliff.

2. EMS personal do not have enough talk-in range on 5W portables to the Airport site.

3. There is a need for an EMS repeater at Tin Can Hill. A trial installation encountered intermod problems. Perhaps another EMS frequency pair needs to be licensed and installed.

Future Requirements

1. Iron Mountain has been identified as a good tower site location from land availability and coverage perspectives, but also has a lot of iron in the ground, possibly detrimental to propagation.

2. Sweet Grass would like to consider digital pagers, primarily for lower cost pager units than the current Minitor 4 voice pagers.

The draft of this record was sent to Joe Hansen on April 25, 2005.
Corrected draft was returned to CTA Communications on May 3, 2005.

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency: **Sweet Grass County Sheriff**

File Name: **Sweet Grass - Sheriff Interview Recor.doc**

Date of Interview: **3/31/05**

Location of Interview: **Big Timber, MT**

Persons Interviewed: **Dan Tronrud; Kerry O'Connell**

CTA Interviewer: **Nathan McClure**

The following points were conveyed to CTA during this interview:

Organization and Responsibilities

1. Dan Tronrud is the Sheriff of Sweet Grass County. There are a total of 5 deputies plus the Sheriff in addition to the office staff.

2. Kerry O'Connell is the DES Deputy. As such, she is also in charge of the dispatch function.

Present Situation

1. 2 new Motorola Quantar P25 base stations were being installed on the day of the interview. One is for the Sheriff's Channel; the other is for the Local Government channel. The ambulance service is paged on a different channel, but uses the same channel as the fire department to communicate with dispatch.

2. Sweet Grass County currently provides basic 911 service. The County is working on upgrading to enhanced 911. Wireless 911 calls are currently routed to the administrative lines (Phase 0).

3. In addition to dispatch duties, the dispatchers are responsible for civil process; concealed weapons permits; data processing; records maintenance; transcribing statements; processing warrants; monitoring child visitation exchanges; issuing livestock permits; and monitoring and tending to prisoners when necessary.

4. The County just received a portable repeater.

Present Problems

1. Coverage issues – Main and West Boulder; Bridger Creek; Tony Creek; See map.

2. Coordination with Park County and others on frequency compatibility issues.

3. Privacy Issues – too many people have scanners. The County has scramblers, but they are of limited effectiveness.

4. Pager coverage is significantly less than two way radio coverage. Paging is done from a different site with a lower powered transmitter.

5. Incompatible radios. Programming is inconsistent. Priority channels differ between agencies and sometimes within the same agency.

6. The paging channel is used by others (hospital, nursing home, etc.) Also, the frequency is the same as the link to the Monument Repeater.

7. There is a lack of training on proper radio procedures.

8. Dispatch uses control stations to access the repeaters. As a result, there is no way for the dispatchers to override field units.

9. The secondary dispatch position uses a mobile radio. It has more channels than the primary position. In addition, it is the only position with scrambler. The operator must move from the main position to the secondary. This is awkward and confusing, especially for a new dispatcher.

Future Requirements

None.

Additional Comments

None.

The draft of this record was sent to Kerry O'Connell on April 25, 2005.
Corrected draft was returned to CTA Communications on May 15, 2005.

Kerry O'Connell
Sweet Grass County Sheriff's Office
PO Box 567
Big Timber, MT 59011

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CTA COMMUNICATIONS
FINAL INTERVIEW RECORD

Organization/Agency:	**Sweet Grass County**
File Name:	**Sweet Grass County - General Interview Record .doc**
Date of Interview:	**3/31/05**
Location of Interview:	**Big Timber, Montana**
Persons Interviewed:	**Kerry O'Connell**
CTA Interviewer:	**Nathan McClure**

The following points were conveyed to CTA during this interview:

<u>Organization and Responsibilities</u>

1. The medical facility consists of a 3 bed medical assistance facility (ER), 3 trauma beds, 3 medical beds in combination with a 52 bed nursing home facility.

2. The Sweet Grass County Ambulance Service has 1 EMT-A; 3 EMT-I level providers. The rest of the members are EMT- B's.

3. The Big Timber Fire Department covers the entire county.

4. The Sweet Grass County Sheriff's Department and the Montana Highway Patrol are the law enforcement providers.

<u>Present Situation</u>

1. Sweet Grass County units use two primary channels – the law enforcement channel and the local government channel. There is also a tactical channel.

2. Sweet Grass County is experiencing limited growth at this time.

3. The Montana Highway Patrol has approximately 160 uniformed personnel at this time statewide.

Present Problems

1. Coverage issues – Main and West Boulder; Bridger Creek; Tony Creek; See map.

2. Radio Discipline. There is a lack of training on channel use and radio procedures.

3. Pager coverage is unsatisfactory.

4. The County Law Enforcement repeater; the County Local Government Repeater and the Montana Highway Patrol all use the same site with a "homemade" combiner. The combiner is not adequate.

5. Hospital/Ambulance communications is challenging. The hospital can't hear the ambulance and vica-versa.

6. Privacy Issues – need improved encryption.

Future Requirements

1. Need an EMS Repeater for the hospital.

2. Need to move non-emergency traffic off of primary channels.

Additional Comments

1. The State of Montana is building a statewide mobile data system. Phase 2 will include Sweet Grass County. It is scheduled to be completed this calendar year.

The draft of this record was sent to Kerry O'Connell on April 25, 2005.
Corrected draft was returned to CTA Communications on May 15, 2005.

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0101	**Site Name**		**Site Type**
	Bridger Ridge	**Site Contact**	**LMR / MW**

North of Bozeman Mountain at Bridger Ski Area

Robert Leo
6790 S. Third Road
Bozeman, Montana 59715-8353
(406) 586-8021

Survey Date	**Surveyors**
04/07/2005	DRA

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.81688	110.92961

Site Access Requirements

Site access is Ski lift, helicopter, hiking trail. Hike 1000 ft. vertical, 500 ft. trail (30 mins.).

Electric Utility N/A

Telephone Carrier

Site Description

Mountain ski resort with two buildings and tower. The communications equipment is located in both buildings.

Tower Description

Please refer to Tower Information. There are two 28 ft self-supporting towers.

Facility Grounding System

Several ground rods.

Building Assessment

Brown building - Wood, exterior sheet metal siding and roof. Green building - Wood, exterior sheet metal siding and roof; poor rating.

Communication Shelter Manufacturer/Model

Communication Shelter Notes:

The green building is not prefabricated and has a 22 in. X 28 in. access hole in the roof. Communications equipment is located in this building also.

Land Mobile Radio Equipment

Manufacturer: GE
Model: MASTR II
Power: 120 V
Alarms: No
Redundancy Configuration No
Notes: Brown building equipment.
Station Name: Highway Patrol
Remote Access No

FREQUENCIES

Transmit (MHz):	154.6800	**Call Sign:**	WPEZ831
Receive (MHz):	155.4600	**FCC File No:**	
Transmit Power (watts):	50	**Antenna Height (ft):**	6

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: Rx Multicoupler - Sinclair

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power:
Alarms:
Redundancy Configuration
Notes: Green building - Model, GE Zetron Paging Controller. TAIT Pager P.A.
Station Name: County Paging
Remote Access No

FREQUENCIES

Transmit (MHz):	460.025	**Call Sign:**	WPXK206
Receive (MHz):	465.025	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	30

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar
Power:
Alarms:
Redundancy Configuration
Notes: Brown building equipment
Station Name: Unknown
Remote Access

FREQUENCIES

Transmit (MHz):	Unknown	**Call Sign:**	Unknown
Receive (MHz):	Unknown	**FCC File No:**	
Transmit Power (watts):	80	**Antenna Height (ft):**	N/A

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar
Power: 110 V
Alarms:
Redundancy Configuration
Notes: Brown builiding equipment - Linked over the air from High Flat. 24 volt battery backup, 4 hrs.
Station Name: Unknown
Remote Access No

FREQUENCIES

Transmit (MHz):	Unknown	**Call Sign:**	Unknown
Receive (MHz):	Unknown	**FCC File No:**	
Transmit Power (watts):	80	**Antenna Height (ft):**	N/A

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar
Power: 24 VAC
Alarms:
Redundancy Configuration
Notes: Green building - Mobile data
Station Name: Unknown
Remote Access No

FREQUENCIES

Transmit (MHz):	Unknown	**Call Sign:**	Unknown
Receive (MHz):	Unknown	**FCC File No:**	
Transmit Power (watts):	Unknown	**Antenna Height (ft):**	N/A

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Green building - wall heater.

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Brown building - Max temperature 85 degrees, minimum temperature 16 degrees.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 0

Ports Used: 0

Notes: Brown building - Hole in wall.

Microwave Equipment

Service:	Digital	**Power:**	Unknown
Manufacturer:	Stratex	**Radio Configuration:**	Unknown
Model:	DXR		
Aligned Site:	High Flat	**Transmit (MHz):**	11668.750
Receive (MHz):	11178.750	**Transmit Power:**	Unknown
Call Sign:	WPXF963	**FCC File No.:**	

MULTIPLEXER

Manufacturer: Unknown
Model: Unknown

Analog Channel Capacity:

Digital Channel Capacity: Unknown

ALARM SYSTEM

Unknown

Microwave Notes: Green building - State microwave; Part of mobile data.

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax / Waveguide	Jumper
Length (ft):	**Length (ft):**
Type:	**Type:**
Diameter (inches):	**Diameter (inches):**

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
Rohn	Self-Supporting	28	Unknown	No	No

Horizontal Cable Line Bridge
None.

Ladder
☑ Climbing ☐ Cable

Tower Climbing Ladder
None.

Tower Grounding System
Brown building - Ground wire to rod.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
Rohn	Self-Supporting	28	Unknown	No	No

Horizontal Cable Line Bridge
None.

Ladder
☐ Climbing ☐ Cable

Tower Climbing Ladder
None.

Tower Grounding System
Green building - Cannot inspect due to snow.

Electrical System

EMERGENCY GENERATOR
Manufacturer:
Model Number:

Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator:

TRANSFER SWITCH

Manufacturer:
Model Number:
Voltage: 0
Ampere: 0
Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Green building - Miscellanous ground wires. Brown building - Various ground wires (no rating).

CHARGER

Manufacturer: M/A-COM
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: Brown building - M/A-COM Green building - No description acquired.

BATTERY PLANT

Manufacturer:
Model Number:
Ampere-Hour Rating: 0
Output Voltage: 0
Notes: Both buildings - Miscellanous mix of batteries.

Roof Top Tower Information

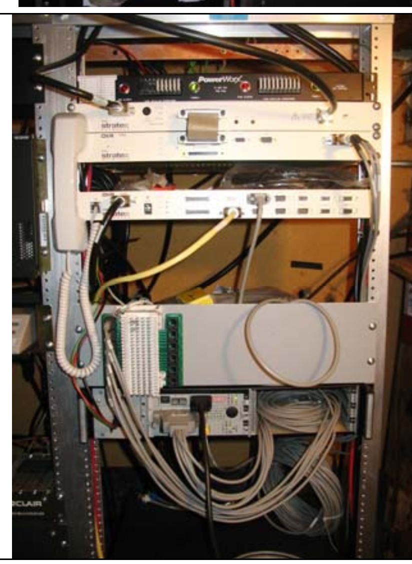
Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Not informed of any.		Green building - Wood covered with sheet metal.

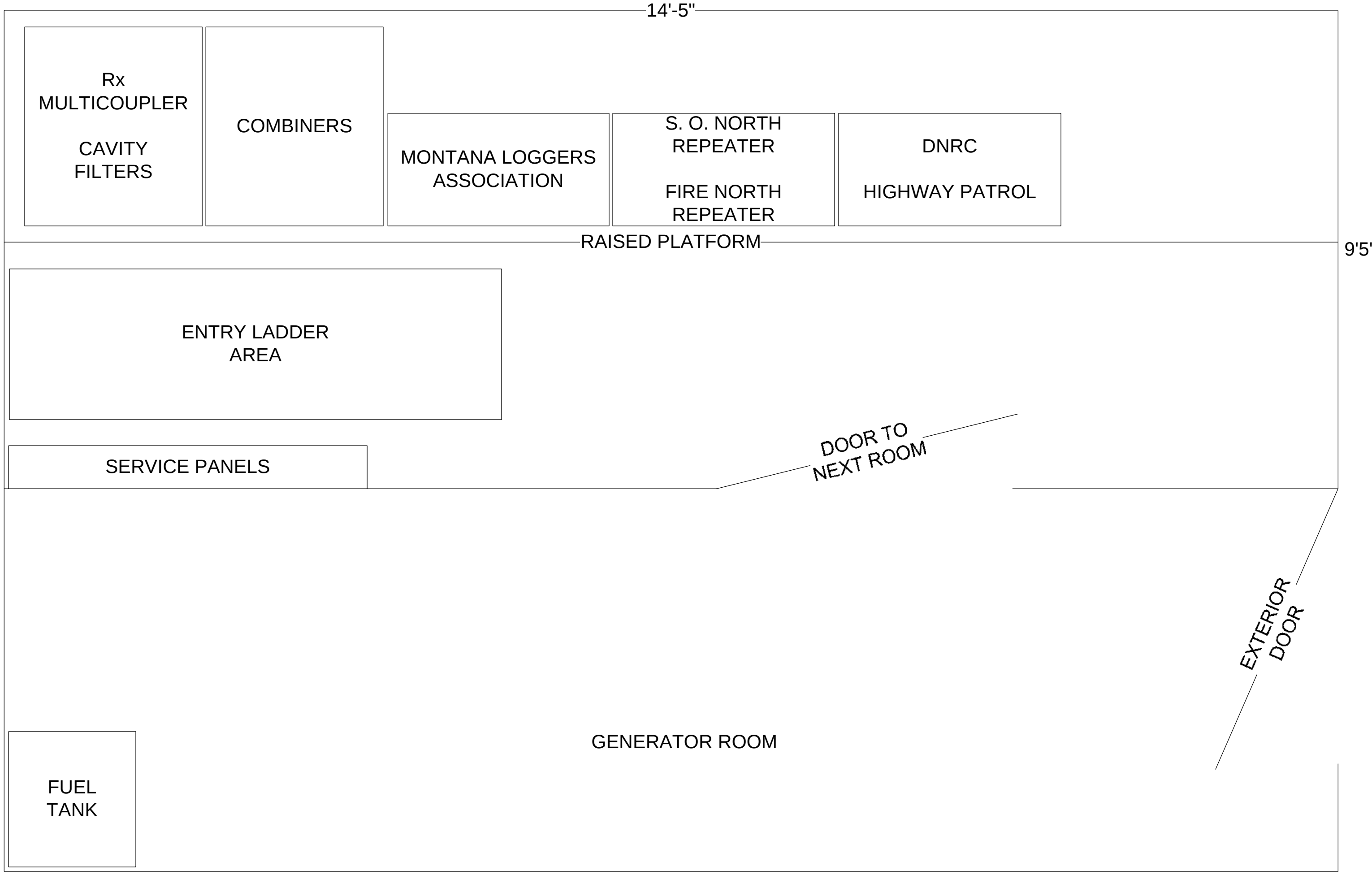
Description: Roof top brace.
Bldg Entry: Could not determine due to snow.
Notes: None.

Site Name: 0101
County Name: Gallatin







	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/2/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

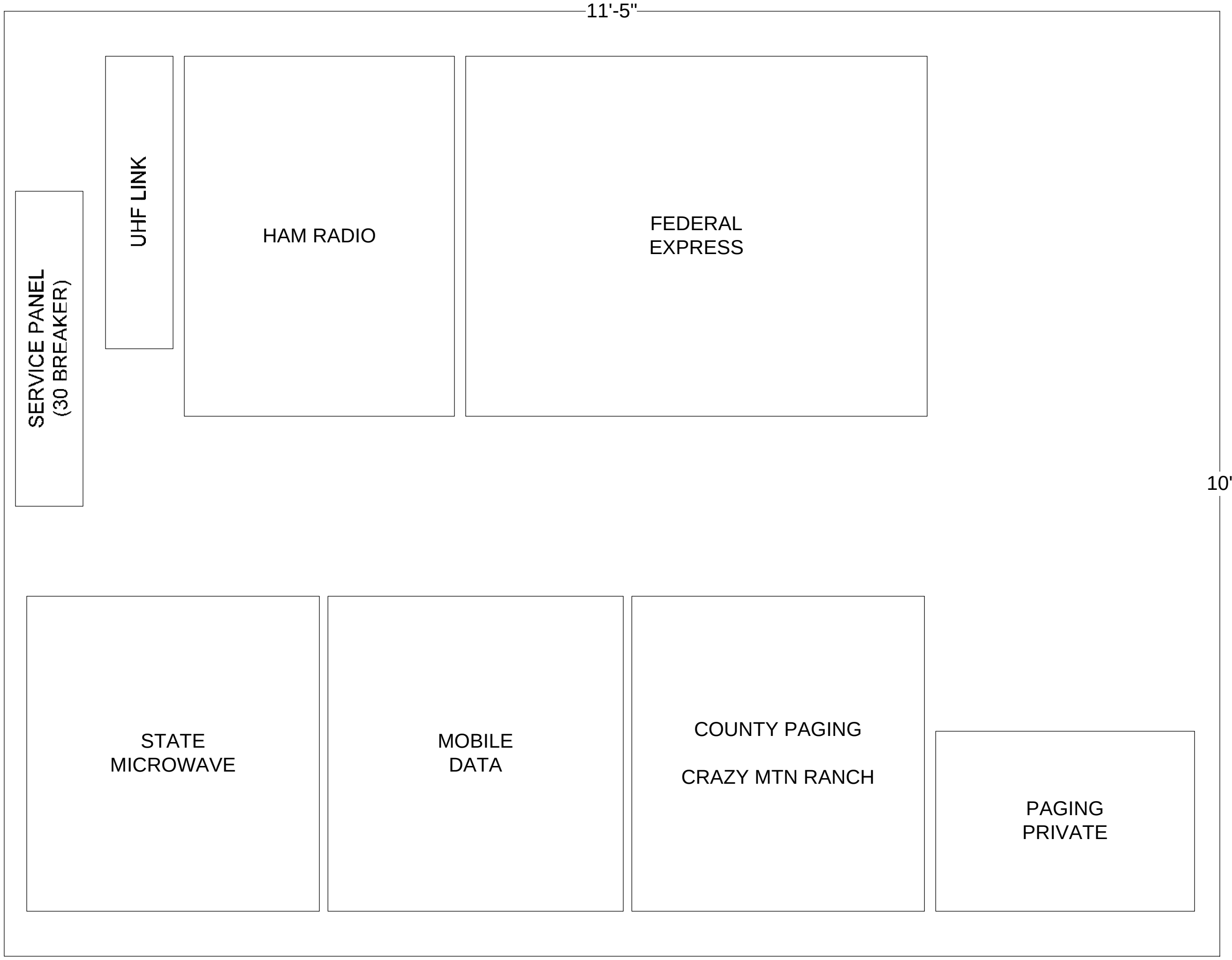
COMMUNICATIONS
AN HSMM COMPANY
WWW.CTACOMMUNICATIONS.COM

CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
BRIDGER RIDGE (Brown Bldg. – Downstairs)

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0101-B	N/A	1 OF 1



NAME		DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/2/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
BRIDGER RIDGE (Green Bldg. – Downstairs)

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0101-G	N/A	1 OF 1

0102	**Site Name**		**Site Type**
	Bozeman Fire	**Site Contact**	**LMR**

34 N Rouse Avenue, Bozeman, Montana, 59715

Ben Hess
615 16th Street
Bozeman, Montana 59715
(406) 582-2085

Survey Date	**Surveyors**
04/05/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.67973	111.03203

Site Access Requirements

Site access is through downtown Bozeman into parking lot area. The antennas are located on top of the hose tower building.

Electric Utility N/A

Telephone Carrier N/A

Site Description

The Bozeman Fire station is located at an intersection and is surrounded by other buildings. A parking lot is located on the premises.

Tower Description

There is no tower at this site.

Facility Grounding System

No outside grounding system surveyed.

Building Assessment

Multiple adjoining buildings, single and multi-level with a hose tower. Concrete block with concrete and brick exterior.

Communication Shelter Manufacturer/Model

None None

Communication Shelter Notes:

There is no communications shelter located at this site.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Radius M10
Power: AC
Alarms: No
Redundancy Configuration No
Notes: Transmitter Model# M120, Radius GR300
Station Name: Station 1 (Sanitation Dept - Paging)
Remote Access No

FREQUENCIES

Transmit (MHz):	453.625	**Call Sign:**	WPHY630
Receive (MHz):	458.625	**FCC File No:**	
Transmit Power (watts):	40	**Antenna Height (ft):**	90

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Did not visually see HVAC equipment.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 2

Ports Used: 2

Notes: A piece of pipe and a roof top entry access panel is used to run cable to equipment located on roof of fire tower.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Other - Roof Mount	80	Unknown	No	No

Horizontal Cable Line Bridge
No cable bridge.

Ladder
☐ Climbing ☐ Cable

Tower Climbing Ladder
No ladder.

Tower Grounding System
N/A

Electrical System

EMERGENCY GENERATOR
Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

There is no visible grounding where the Sanitation department radio equipment is located.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

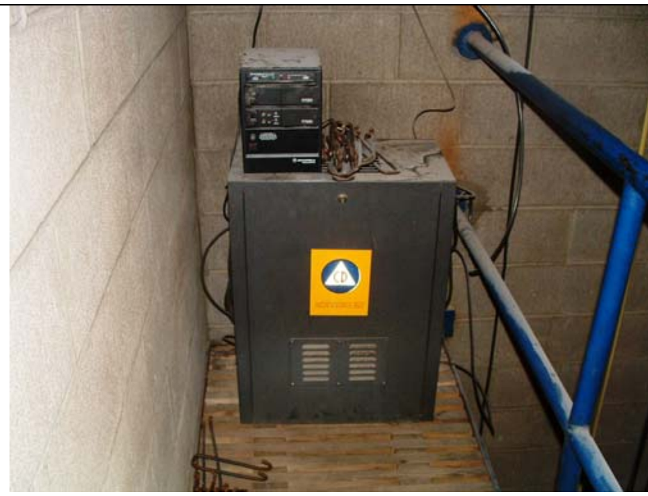
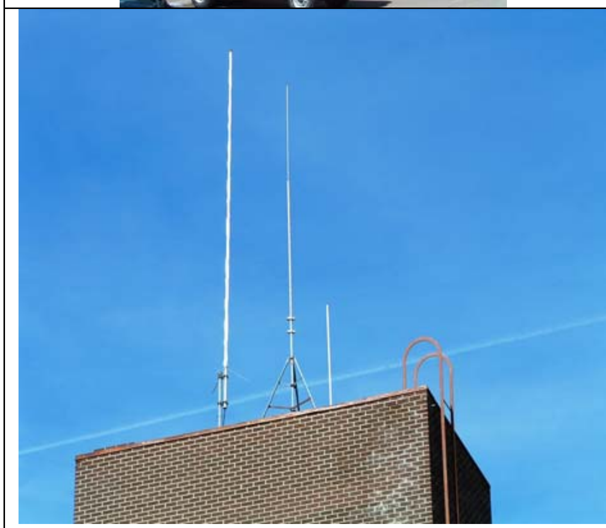
Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Not informed of any.		

Description: Three antennas are located on the roof of the hose tower.

Bldg Entry: LMR enters the building through a hole in the roof located in the hose tower.

Notes: None.

Site Name: 0102
County Name: Gallatin


0103	**Site Name**		**Site Type**
	High Flat	**Site Contact**	**LMR / MW**

High Flat Mountain, Gallatin, Montana, 59715

Ben Hess
615 So. 16th St.
Bozeman, Montana 59715
(406) 582-2085

Survey Date 04/05/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.63766	111.26780

Site Access Requirements

Site access is through winding, dirt mountain side roads. Access is through four barbed wire gates on the premises.

Electric Utility Northwest Energy

Telephone Carrier N/A

Site Description

Remote mountain top site with communications shelter, generator building, and tower. There is also another building and tower near this site.

Tower Description

Please refer to Tower Information. The tower is a guyed 80 ft tower.

Facility Grounding System

Buried ring grounding system (HALO).

Building Assessment

Pre-fabricated shelter has gravel outer walls, preformed siding walls, and the flooring is 12 in X 12 in tile flooring.

Communication Shelter Manufacturer/Model

Thermo Bonds Building

Communication Shelter Notes:

The shelter is a pre-fabricated Thermo Bonds Building shelter containing the radio equipment.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power: AC
Alarms: No
Redundancy Configuration No
Notes: None.
Station Name: Fire North Base
Remote Access No

FREQUENCIES

Transmit (MHz): 154.055
Receive (MHz): 158.880
Transmit Power (watts): 80

Call Sign: Unknown
FCC File No:
Antenna Height (ft): 70

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power: AC
Alarms: No
Redundancy Configuration No
Notes: Simplex channel for ambulance.
Station Name: White (State EMS/Hospital)
Remote Access No

FREQUENCIES

Transmit (MHz): 155.280
Receive (MHz): Simplex
Transmit Power (watts): 80
Call Sign: WNKG692
FCC File No:
Antenna Height (ft): 40

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power: AC
Alarms: No
Redundancy Configuration No
Notes: None.
Station Name: Sheriff Office TAC
Remote Access No

FREQUENCIES

Transmit (MHz): 155.580
Receive (MHz): Simplex
Transmit Power (watts): 80
Call Sign: Unknown
FCC File No:
Antenna Height (ft): 25

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: Simplex

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power: AC
Alarms: No
Redundancy Configuration No
Notes: Antenna is a yagi.
Station Name: South Repeater Base
Remote Access No

FREQUENCIES

Transmit (MHz): 155.700
Call Sign: KNIG888
Receive (MHz): 158.790
FCC File No:
Transmit Power (watts): 80
Antenna Height (ft): 30

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Land Mobile Radio Equipment

Manufacturer: Daniels
Model:
Power: 12 VAC
Alarms: No
Redundancy Configuration No
Notes: None.
Station Name: US Forestry Service (USFS)
Remote Access No

FREQUENCIES

Transmit (MHz): 164.825
Call Sign: Unknown
Receive (MHz): 169.925
FCC File No:
Transmit Power (watts): 40
Antenna Height (ft): 70

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name: Telewave
Duplexer Model: TPRD-4544
Notes: Misc. equipment - Interconnect controller, Vega DSP223

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power: AC
Alarms: No
Redundancy Configuration No
Notes: UHF
Station Name: Bozeman Deaconess Hospital (Paging)
Remote Access No

FREQUENCIES

Transmit (MHz): 453.425 **Call Sign:** WPML388
Receive (MHz): 458.425 **FCC File No:**
Transmit Power (watts): 40 **Antenna Height (ft):** 50

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax		Jumper	
Length (ft)		Length (ft)	3
Type		Type	
Diameter (inches)		Diameter (inches)	

CIRCUIT DUPLEXER

Name:
Duplexer Model: Celwave (6) Cavity
Notes: None.

Land Mobile Radio Equipment

Manufacturer: Tait
Model: T800
Power: DC
Alarms: No
Redundancy Configuration No
Notes: Analog TX; Receive is feed from MW wireline.
Station Name: Gallatin Co Paging
Remote Access

FREQUENCIES

Transmit (MHz): 458.425 **Call Sign:** WPML388
Receive (MHz): Simplex **FCC File No:**
Transmit Power (watts): 80 **Antenna Height (ft):** 85

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax		Jumper	
Length (ft)		Length (ft)	
Type		Type	
Diameter (inches)		Diameter (inches)	

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar T5365A
Power: AC
Alarms: No
Redundancy Configuration No
Notes: 24V battery Backup.
Station Name: Mobile Data 1
Remote Access Yes

FREQUENCIES

Transmit (MHz): 460.450
Receive (MHz): 465.450
Transmit Power (watts): 45
Call Sign: Unknown
FCC File No:
Antenna Height (ft): 65

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: Combiner system

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power: AC
Alarms: No
Redundancy Configuration No
Notes: 8 channel standby radio.
Station Name: Standby
Remote Access No - Wireline controlled.

FREQUENCIES

Transmit (MHz): Unknown
Receive (MHz): Unknown
Transmit Power (watts): 80
Call Sign: Unknown
FCC File No:
Antenna Height (ft): 70

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: Frequencies: TX 153.8150 RX 154.9950/ TX 158.8800 RX 154.0550/ TX 155.6700 RX 154.7250/ TX 158.9100 RX 154.2500/ TX 155.700 RX 158.7900/ TX 153.8150 RX 154.9950/ TX 154.055 RX Simplex/ TX 154.725 RX Simplex

Heating, Ventilation and Air Conditioning

Manufacturer: Bard
Model Number:

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
	Outback Power Systems		0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 6

Ports Used: 5

Notes: 4-1/2 inch ports.

Microwave Equipment

Service:	Digital	**Power:**	24 VDC
Manufacturer:	Stratex	**Radio Configuration:**	Non-Protected
Model:	DXR		
Aligned Site:	Bridger Ridge	**Transmit (MHz):**	11178.750
Receive (MHz):	11668.750	**Transmit Power:**	28
Call Sign:	Unknown	**FCC File No.:**	

MULTIPLEXER

Manufacturer:	Megaplex	**Analog Channel Capacity:**	
Model:	2104	**Digital Channel Capacity:**	1

ALARM SYSTEM

Yes

Microwave Notes: Jumper length (2-1/2 Ft.), Type - Andrews Flex Twist

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax / Waveguide		**Jumper**	
Length (ft):	70	**Length (ft):**	10
Type:	Flex	**Type:**	LMR400
Diameter (inches):	1/2	**Diameter (inches):**	

Microwave Equipment

Service:	Digital	**Power:**	24 VDC
Manufacturer:	Stratex	**Radio Configuration:**	Non-Protected
Model:	DXR		
Aligned Site:	Law & Justice Ceneter	**Transmit (MHz):**	11176.250
Receive (MHz):	11666.250	**Transmit Power:**	28
Call Sign:	Unknown	**FCC File No.:**	

MULTIPLEXER

Manufacturer: Megaplex

Model: 2104

Analog Channel Capacity:

Digital Channel Capacity: 1

ALARM SYSTEM

Yes

Microwave Notes: Jumper length (2-1/2 Ft.), Type - Andrews Flex Twist

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax / Waveguide

Length (ft): 30

Type: Flex

Diameter (inches): 1/2

Jumper

Length (ft): 10

Type: LMR400

Diameter (inches):

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID:

Manufacturer: Outback Powe

Model Number:

Amperes:

Fuse Positions:

Output Voltage

Voltage:

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Guyed	80	Unknown	No	No

Horizontal Cable Line Bridge

Grated, spiked.

Ladder

☑ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Tower ground is single wire to buried ground rod. Not tied into Halo grounding system.

Electrical System

EMERGENCY GENERATOR

Manufacturer: Generac Systems

Model Number: 3396790 100

Fuel: Propane **Fuel Capacity (gls):** 4165
kW: 25 **kVA:** 25
Voltage: 120/240
Phases: 1
Wires:
Notes on Generator: None.

TRANSFER SWITCH

Manufacturer: Generac Systems
Model Number: 0040362
Voltage: 480
Ampere: 150
Electrical System Notes: None.

DISCONNECT SWITCH

☑ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Halo ring ground system.

CHARGER

Manufacturer: Outback Power Systems
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: None.

BATTERY PLANT

Manufacturer: C & D Technologies
Model Number: UPS6-620
Ampere-Hour Rating: 200
Output Voltage: 0
Notes: Eight each.

Roof Top Tower Information

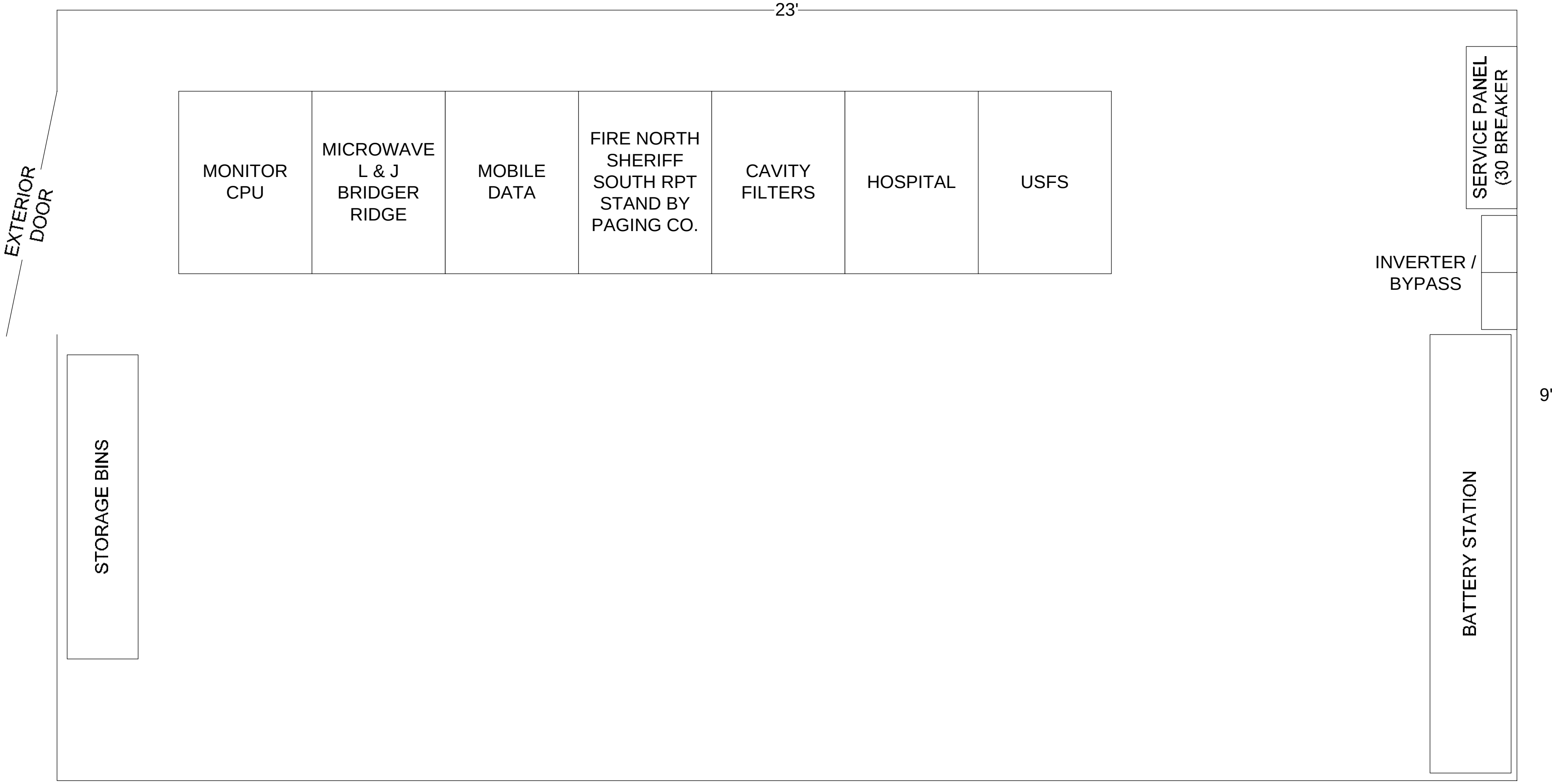
Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	None.		Metal.

Description: None.
Bldg Entry: LMR and microwave enter the building through the port entry panel.
Notes: Key is needed to enter the communications shelter and building.

Site Name: 0103
County Name: Gallatin





	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/3/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
HIGH FLAT

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0103	N/A	1 OF 1

0104	**Site Name**		**Site Type**
	Kenyon Drive Water Tank	**Site Contact**	**LMR**

Off Kenyon Drive, Bozeman, Montana, 59715

John Alston
814 N. Bozeman, P.O. Box 1230
Bozeman, Montana 59771
(406) 582-3200

Survey Date 04/05/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N) 45.66205
Longitude(W) 111.02525

Site Access Requirements

Site access is through paved roads in residential area which provide easy access to the facility. The water tank and communications shelter are contained within separate locked chain-link fences.

Electric Utility Northwest Energy

Telephone Carrier N/A

Site Description

Site with communications shelter and water tank. The radio equipment is located in the communications shelter. The communications shelter is about 75 ft away from the water tank.

Tower Description

None. Omni-directional antennas attached to water tank.

Facility Grounding System

Buried grounding rods at the corner of the building.

Building Assessment

Pre-fabricated shelter has gravel outer walls, preformed siding walls, and the flooring is 12 in X 12 in tile flooring.

Communication Shelter Manufacturer/Model

Thermo Bonds Buildings N/A

Communication Shelter Notes:

The shelter is a 7 ft 3 in X 20 ft pre-fabricated Thermo Bonds Building containing the radio equipment. The ceiling is 8 ft high.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar
Power: AC
Alarms: No
Redundancy Configuration Possible repeater; backup Bozeman Landfill.
Notes: None.
Station Name: Bozeman Police
Remote Access

FREQUENCIES

Transmit (MHz):	154.725	**Call Sign:**	KOA404
Receive (MHz):	155.670	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	20

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: Combiners are being used.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar
Power:
Alarms:
Redundancy Configuration YES - Bozeman Water Sewer Dept. - Repeater

Notes: None.

Station Name: Bozeman Water Sewer Department

Remote Access No

FREQUENCIES

Transmit (MHz):	158.820	**Call Sign:**	Unknown
Receive (MHz):	156.015	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	20

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: TPL 100

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Dual

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 6

Ports Used: 2

Notes: Four lines of coax - Two in each port.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: Motion detector will be installed at a future date.

Converter

Equipment ID: **Manufacturer:** **Model Number:**
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Other - Roof Mount	50	Unknown	No	No

Horizontal Cable Line Bridge
None.

Ladder
☑ Climbing ☐ Cable

Tower Climbing Ladder
Water tank ladder

Tower Grounding System
N/A

Electrical System

EMERGENCY GENERATOR

Manufacturer:
Model Number:
Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator: Generator has not been installed.

TRANSFER SWITCH

Manufacturer:
Model Number:
Voltage: 0
Ampere: 0
Electrical System Notes: None.

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Equipment room grounding is adequate for communications shelter. Ben Hess has grounding study that was performed by outside consultant.

CHARGER

Manufacturer:
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer: Power Sonic

Model Number: PS-121000UH

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: 12 volt battery system.

Roof Top Tower Information

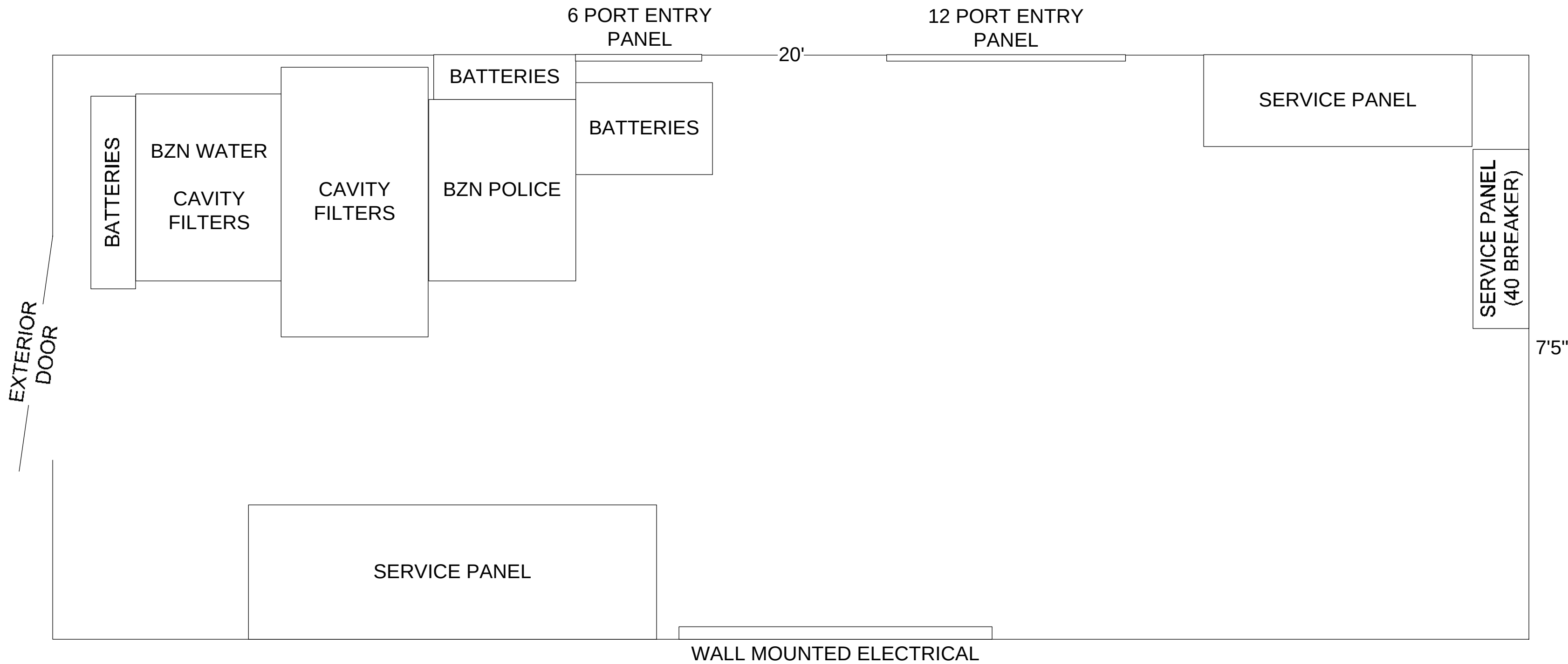
Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	None.		Metal.

Description: SCADA System - Dish (grid) and omni-directional antenna.

Bldg Entry: LMR enters through two RF entry ports on side of communications shelter facing water tank.

Notes: Communications shelter and water tank have their own fencing. Key is needed to enter the chainlink fence surrounding the communications shelter.

Site Name: 0104
County Name: Gallatin



	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/4/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
KENYON DRIVE WATER TANK

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0104	N/A	1 OF 1

0105	**Site Name**		**Site Type**
	Nixon Ridge	**Site Contact**	**LMR**

Off High Flat Road, Three Forks, Montana, 59752

Ben Hess
615 So. 16th Street
Bozeman, Montana 59715
(406) 582-2085

Survey Date	**Surveyors**
04/05/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.96544	111.33845

Site Access Requirements

Site access is through winding, dirt mountain side roads. Two locked gates are along the route.

Electric Utility Northwest Energy

Telephone Carrier 360 Networks

Site Description

One-quarter acre site with fenced in tower, communications shelter, and a building that houses the generator and other equipment.

Tower Description

See Tower Information. The tower is a 100 ft, 3-legged self-supporting tower.

Facility Grounding System

Buried ring grounding system (HALO).

Building Assessment

The communications shelter and the building that houses the generator are stucco, foam walls, tile flooring, and paneling.

Communication Shelter Manufacturer/Model

LaBlanc L & R Communications N/A

Communication Shelter Notes:

The radio equipment is located in the communications shelter.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar T5365A
Power: AC
Alarms: No
Redundancy Configuration No
Notes: AC power with DC backup, powered up by inverter.
Station Name: Gallatin County Roads
Remote Access No

FREQUENCIES

Transmit (MHz): 151.340
Receive (MHz): 159.240
Transmit Power (watts): 100

Call Sign: WPVU655
FCC File No:
Antenna Height (ft): 80

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: On a combiner.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar T5365A
Power: AC
Alarms: No
Redundancy Configuration No
Notes: AC power with DC backup, powered up by inverter.
Station Name: Fire West
Remote Access No

FREQUENCIES

Transmit (MHz): 154.145
Call Sign: Unknown
Receive (MHz): 158.865
FCC File No:
Transmit Power (watts): 100
Antenna Height (ft): 80

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: On a combiner.

Land Mobile Radio Equipment

Manufacturer: Tate
Model: T8100 Series
Power: AC
Alarms: No
Redundancy Configuration No
Notes: Antenna is 4 pole dipole.
Station Name: Gallatin Co. Paging
Remote Access No

FREQUENCIES

Transmit (MHz): 453.425
Call Sign: WPML388
Receive (MHz): 458.425
FCC File No:
Transmit Power (watts): 80
Antenna Height (ft): 90

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: Interconnected with Zetron Model 66, 80 watt station, output 40 watts at duplexer.

Heating, Ventilation and Air Conditioning

Manufacturer: ClimateTel
Model Number:

BTU:	**Amperes:**	**Voltage:**	**Phases:**

Description: None

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
	Belkin		0	0

UPS Description: Small power supply plugged into AC power.

Waveguide Entrance

Total Ports: 14

Ports Used: 8

Notes: 4-1/2 inch entry ports.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
Yes	Andrew		10	4

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** C & D Power **Model Number:** ART48AC50E

Amperes: 27 **Fuse Positions:**

Output Voltage **Voltage:** 120/208/240

Notes: 2 Each - Only one was powered on.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
MicroFlex	Self-Supporting	100	Unknown	No	No

Horizontal Cable Line Bridge

2 Each - Two pieces of steel channel.

Ladder

☑ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Tower grounding is two grounds to each leg (3 legs), tied into ring grounding system (HALO).

Electrical System

EMERGENCY GENERATOR

Manufacturer: Kohler Fast Response II

Model Number: GDRZ282

Fuel: Propane **Fuel Capacity (gls):**
kW: 33 **kVA:** 41
Voltage: 120/240
Phases: 3
Wires:
Notes on Generator: 115 Ampres.

TRANSFER SWITCH

Manufacturer: Kohler
Model Number: K-164231
Voltage: 240
Ampere: 150
Electrical System Notes: None.

DISCONNECT SWITCH

☑ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Grounding for equipment room bus bar wall mounted flatbar. Paging and VHF equipment grounded to bus bar by single wire. Big copper strands run from grounding bus bar to exterior grounding ring (HALO).

CHARGER

Manufacturer:
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: None.

BATTERY PLANT

Manufacturer:
Model Number:
Ampere-Hour Rating: 0
Output Voltage: 0
Notes: 12 volt battery; in series

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	None.		

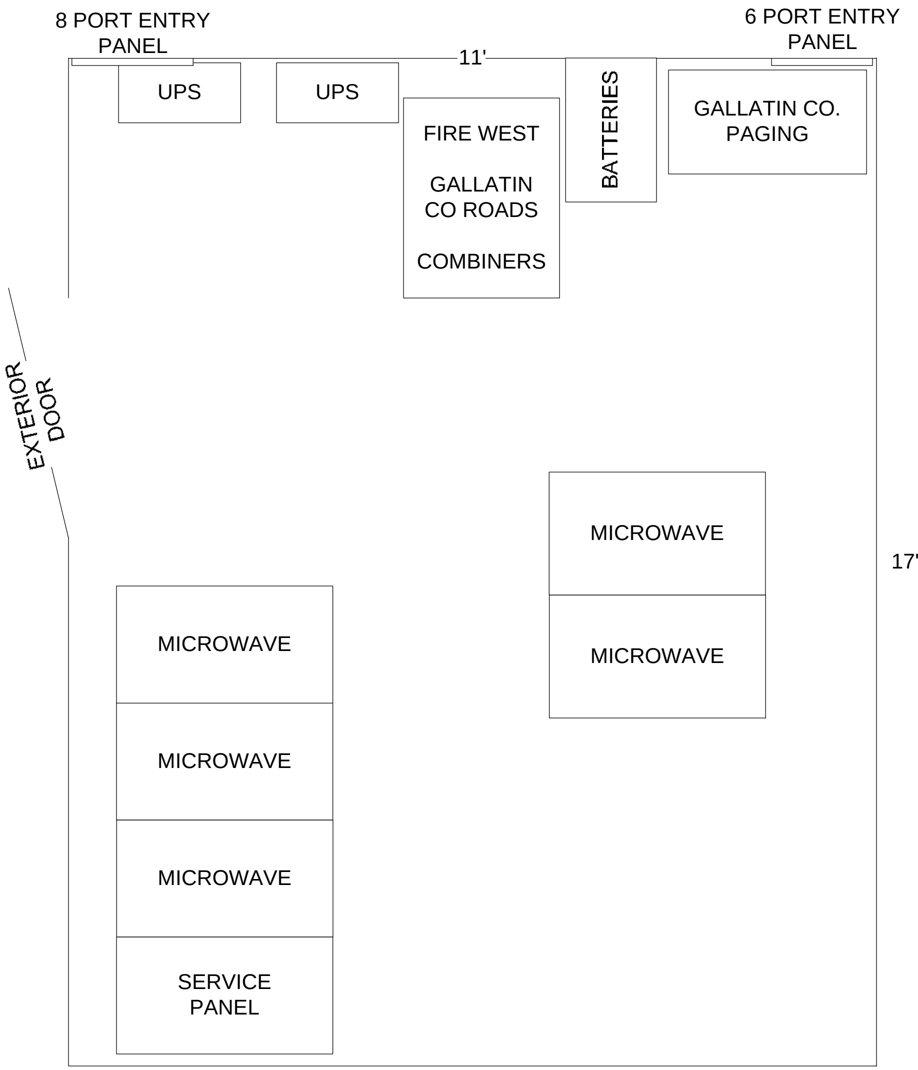
Description: None.

Bldg Entry: LMR and Microwave enter the building through two entry port panels located on the West side of the communications shelter.

Notes: Key is needed to get into chainlink fence that surrounds the tower, shelter, and building.

Site Name: 0105

County Name: Gallatin



	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/4/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
LOGAN REPEATER

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0105	N/A	1 OF 1

0106	**Site Name**		**Site Type**
	Cobleigh Hall Repeater	**Site Contact**	**LMR**

MSU Cobleigh Hall, Bozeman, Montana 59717

Ben Hess
615 So. 16th St.
Bozeman, Montana 59715
(406) 582-2085

Survey Date	**Surveyors**
04/05/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.66641	111.04607

Site Access Requirements

Site access is through MSU campus to the Cobleigh Hall building. The radio equipment and antenna are located on the roof level and is accessible by elevator or stairway.

Electric Utility Northwest Energy

Telephone Carrier N/A

Site Description

Seven story brick building located on MSU campus. The radio equipment is located in a room on the roof.

Tower Description

Please refer to Tower Information. There is no tower at this site. 6 ft. Omni-directional antenna is mounted on the roof top.

Facility Grounding System

No outside grounding surveyed at this site.

Building Assessment

Radio equipment is located in a small room that is on the roof. This is a seven-story brick building.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power: AC
Alarms: No
Redundancy Configuration No
Notes: None.
Station Name: Cobleigh Repeater
Remote Access No

FREQUENCIES

Transmit (MHz):	Unknown	**Call Sign:**	Unknown
Receive (MHz):	Unknown	**FCC File No:**	
Transmit Power (watts):	Unknown	**Antenna Height (ft):**	6

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: Carrier **Model Number:** 38TK036320DL

BTU: **Amperes:** **Voltage:** 208/230 **Phases:** 1

Description: Serial #2790E19130 - 60 Hz

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 1

Ports Used: 1

Notes: Single 5" entry port hole. Not sealed.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Other - Roof mount	70	N/A	No	N/A

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Polyphaser on the coax coming in from antenna. Could not survey the antenna mounting for grounding.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator: No generator surveyed at this site.

TRANSFER SWITCH

Manufacturer:
Model Number:
Voltage: 0
Ampere: 0
Electrical System Notes: The room where the radio equipment is located is full of trash, miscellanous wire, and equipment.

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Bus bar attached to wall; polyphaser on antenna coax coming into building. Unshielded copper wire running from bus bar inside wall to radio equipment cabinent; unshielded copper wire running from bus bar around room and welded to pipe clamp. Pipe extends down through the flooring.

CHARGER

Manufacturer:
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: This was not plugged in.

BATTERY PLANT

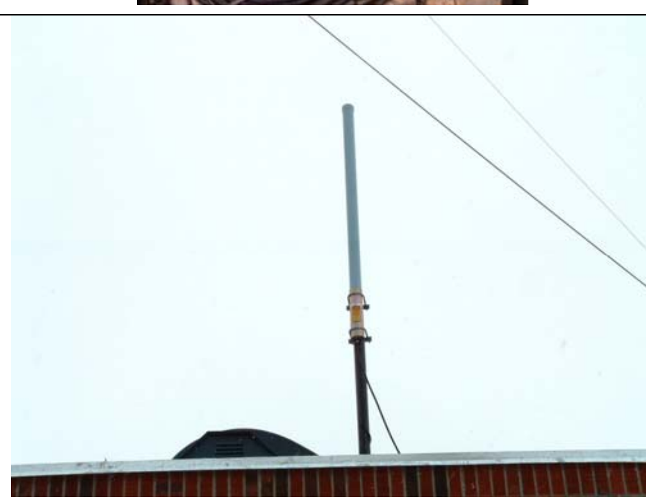
Manufacturer:
Model Number:
Ampere-Hour Rating: 0
Output Voltage: 0
Notes: None.

Roof Top Tower Information

Roof Top	**Bldg Restrict**	**Roof Surface**	**Roof Surface Description**
Yes	Roof-top doors are locked.		

Description: Omni-directional antenna.
Bldg Entry: LMR entered the building through an unsealed single port entry hole.
Notes: None.

Site Name: 0106
County Name: Gallatin



0107	**Site Name**		**Site Type**
	Msu Nelson Story Tower	**Site Contact**	**LMR**

Bldg. #521 Nelson Story Tower,
Bozeman, Montana, 59715

Ben Hess
615 So. 16th Street
Bozeman, Montana 59715
(406) 582-2085

Survey Date	**Surveyors**
04/05/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.66821	111.05888

Site Access Requirements

Site access is through MSU campus to the Nelson Story building. The radio equipment and antenna's are located on the roof level and is accessible by elevator then a small staircase to the roof.

Electric Utility Northwest Energy

Telephone Carrier N/A

Site Description

Ten story brick building located on MSU campus. The radio equipment is located on the tenth floor in a small room on the roof that is also used for storing cleaning supplies, etc.

Tower Description

Please refer to Tower Information. There is no tower at this site. A 5 ft. omni-directional antenna is mounted on the roof top and another omni-directional antenna is mounted to the side of the building.

Facility Grounding System

No outside grounding surveyed at this site.

Building Assessment

Radio equipment is located in a small room that is on the roof. This is a ten-story brick building.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MSR2000
Power: 250 watts
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Bozeman Fire Station #1
Remote Access

FREQUENCIES

Transmit (MHz):	154.250	**Call Sign:**	WPMB759
Receive (MHz):	158.910	**FCC File No:**	
Transmit Power (watts):	90	**Antenna Height (ft):**	5

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: Two (2) combiners behind cabinent.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MSR2000
Power: 250 watts
Alarms:
Redundancy Configuration
Notes: Tone 141.3
Station Name: Bozeman PD Tatical Repeater
Remote Access

FREQUENCIES

Transmit (MHz):	154.650	**Call Sign:**	KOA404
Receive (MHz):	155.640	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	10

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: Four (4) combiners behind radio equipment cabinent.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 2

Ports Used: 2

Notes: Two (2) holes in brick. One sealed with sealant.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	OTHER - Wall Mount	120	N/A	No	N/A

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

N/A

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Other - Roof Mount	120	N/A	No	N/A

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

N/A

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator: No generator surveyed at this site.

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Ampere: 0

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Radio equipment is grounded using single shielded wire attached to wall mounted bus bar. Two other single shielded wires attached to bus bar. One wire is attached to AC wall outlet w/clamp. One wire is not attached to anything.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Elevator key is required to go up to roof level.		Shingled Roof.

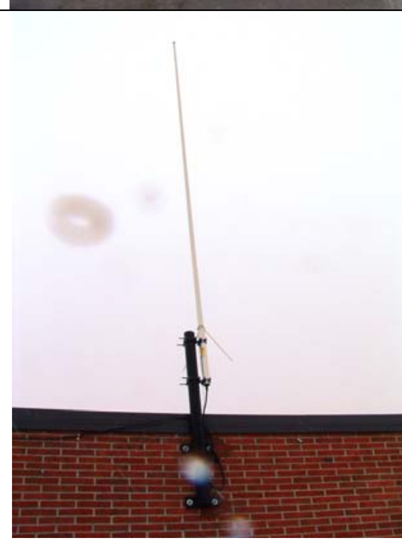
Description: Existing LMR antennas on the Nelson Story building rooftop and building that extends past the rooftop.

Bldg Entry: LMR enters the building from the parapit extending past the roof level and at the base of the roof.

Notes: Shelter area is also used to store miscellanous cleaning supplies and equipment. Elevator entry is by key only to access this floor. Also there is another door that leads to connecting boiler room.

Site Name: 0107
County Name: Gallatin



NAME		DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/4/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
NELSON STORY TOWER

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0107	N/A	1 OF 1

0108	Site Name		Site Type
	Bozeman City Landfill	**Site Contact**	**LMR**

2143 Story Mill Road, Bozeman, Montana, 59715

John Alston
814 N. Bozeman, P.O. Box 1230
Bozeman, Montana 59771
(406) 582-3200

Survey Date 04/06/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.71510	111.02169

Site Access Requirements

Site access is Bozeman city to the landfill. A paved drive to the building, which is surrounded by dirt. The building with the radio equipment, mounted antennas, and a small building are contained within a chain-link fence.

Electric Utility Northwest Energy

Telephone Carrier N/A

Site Description

Landfill site with small building and garage building with two (2) garage doors. The RF equipment is located in a small upper corner area of the garage building.

Tower Description

Please refer to Tower Information. There is no tower. Three (3) wall mounted omni-antennas.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

Concrete block with concrete, brick, and wood exterior with sturdy roof. John Alston communicated that building might be torn down in a few years.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: Kenwood
Model: TKR-840
Power: DC
Alarms: No
Redundancy Configuration No
Notes: None.
Station Name: Streets
Remote Access No

FREQUENCIES

Transmit (MHz): 158.760 **Call Sign:** WPTB560
Receive (MHz): 154.100 **FCC File No:**
Transmit Power (watts): 50 **Antenna Height (ft):** 12

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	Jumper
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: Kenwood
Model: TKR-840
Power: DC
Alarms: No
Redundancy Configuration Kenyon Drive Water Tank
Notes: Backup repeater; not plugged in.
Station Name: Bozeman Water
Remote Access No

FREQUENCIES

Transmit (MHz):	158.820	**Call Sign:**	WNVU917
Receive (MHz):	156.015	**FCC File No:**	
Transmit Power (watts):	50	**Antenna Height (ft):**	15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: Kenwood
Model: TKR-840
Power: DC
Alarms: No
Redundancy Configuration No
Notes: None.
Station Name: Parks (Paging)
Remote Access No

FREQUENCIES

Transmit (MHz):	453.925	**Call Sign:**	WPKP848
Receive (MHz):	458.925	**FCC File No:**	
Transmit Power (watts):	50	**Antenna Height (ft):**	15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 3

Ports Used: 3

Notes: Three holes drilled through outer walls. Two transmission lines come in through the ceiling.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Other - Wall Mount	16	N/A	No	N/A

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

N/A

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator: No generator surveyed at this site.

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes: None.

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

No visible grounding to radio equipment at this site.

CHARGER

Manufacturer: DuraComm

Model Number: RM-251 2M

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	None.		Wood with shingles. Looks sturdy.

Description: None.

Bldg Entry: LMR enters the building through three drilled holes in outer brick walls and a drilled hole in ceiling.

Notes: None.

Site Name: 0108
County Name: Gallatin






0109	Site Name		Site Type
	Law & Justice Center	**Site Contact**	**Dispatch / LMR / MW**

615 So. 16th Street, Bozeman, Montana, 59715

Ben Hess
615 So. 16th Street
Bozeman, Montana 59715
(406) 582-2085

Survey Date	Surveyors
04/02/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.67383	111.06017

Site Access Requirements

Site access is through paved roads into the facility and parking lot. The tower and generator are contained within locked chain-link fences.

Electric Utility NorthWestern Energy

Telephone Carrier Quest / Three Rivers

Site Description

The Law & Justice center is located in the city of Bozeman. The facility contains the 18th Judicial District Court, Municipal Court, Public Safety Answering Point (PSAP), other law enforcement and city agencies, and a 100 ft. self-supporting tower. The detention center is located adjacent to the Law & Justice Center.

Tower Description

Please refer to Tower Information. The tower is a self-supporting 60 ft. tower.

Facility Grounding System

Buried ring grounding system (HALO).

Building Assessment

Concrete block with concrete and brick exterior for dispatch center.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: TAIT
Model: T835-20
Power:
Alarms:
Redundancy Configuration
Notes: None.
Station Name: North
Remote Access

FREQUENCIES

Transmit (MHz):	154.995	**Call Sign:**	WPNW532
Receive (MHz):	154.815	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	65

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	Jumper
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: TAIT
Model: T835-20
Power:
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Bozeman PD
Remote Access

FREQUENCIES

Transmit (MHz):	155.670	**Call Sign:**	KOA404
Receive (MHz):	154.725	**FCC File No:**	
Transmit Power (watts):	60	**Antenna Height (ft):**	45

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: TAIT
Model: T835-20
Power:
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Bozeman FD
Remote Access

FREQUENCIES

Transmit (MHz):	158.910	**Call Sign:**	WPMB759
Receive (MHz):	154.210	**FCC File No:**	
Transmit Power (watts):	50	**Antenna Height (ft):**	29

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: TAIT
Model: T835-20
Power:
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Gallatin Co. (Paging)
Remote Access

FREQUENCIES

Transmit (MHz): 458.425
Receive (MHz): 453.425
Transmit Power (watts): 100
Call Sign: WPML388
FCC File No:
Antenna Height (ft): 65

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: Mitsubishi **Model Number:** PU30EK

BTU: **Amperes:** 30 **Voltage:** 208/130 **Phases:** 2

Description: There are two (2) of these units present.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
	Best Power	Unity/I UT315	208/120	24

UPS Description: None

Dispatch Center

Notes: Quest is telephone service provider for valley area and Three Rivers is telephone service provider for Big Rivers area. Dispatch agencies include Gallatin River

Equipment Room Location - Description: Equipment room is located in a room adjacent to dispatch area. Equipment room is well cooled, well maintained, clean with good lighting. Equipment and cabinets are well labeled and sound from the dispatch area is not heard.

Console Grounding System - Description: N/A - Was not known by staff during the time of site survey.

Grounding Underneath Computer Flooring: ☐ Ye ☑ No

LOGGING RECORDER

Manufacturer: Eventide

Model: VR320

Logging Recorder Notes: Dat Tapes DDS-s 4mm data cartridge.

General Layout: Equipment room is 11 ft wide by 13 ft long. Entrance door 3 ft wide. Flooring is 12" X 12" tile and there are windows on 1 side of room. Equipment racks are located near the side walls leaving center walkway through room and walkways behind equipment.

NUMBER OF DISPATCH AND CALL TAKER POSITIONS

Dispatch: 4

Call Taker: 1

Supervisory: 0

Spare: 0

Dispatched Agencies: Continued from notes section - Bozeman PD, Gallatin Co. Sheriff, Belgrade, Manhattan, Corners Office, Sheriffs Office, and many search and rescue and fire departments. See Notes section above.

Position Notes: N/A

OTHER EQUIPMENT

Miscellaneous and Other Equipment: Overhead Displays/Security Monitors: Yes, Model#: Javelin / installation by Mountain Lock Smithing
Fax Machine: Yes
Copy Machine: Yes

CENTRAL ELECTRONICS UNIT

Manufacturer: Orbacom

Model: TDM-150

Central Electronics Notes: This equipment is located in the dispatch equipment room

Dispatch/Radio Position:# YES

- ☑ **CRT**
- ☑ **Mouse**
- ☑ **Touch Screen**
- ☑ **Track Ball**
- ☑ **Desktop**
- ☑ **Headset**
- ☑ **Footswitch**
- ☑ **Telephone Set**

Computer Terminals and Moniters:

- ☑ **CAD**
- ☑ **NCIC**
- ☑ **Radio**
- ☑ **Security Video Monitor**

Call Taker Position:# YES

- ☑ **CAD**
- ☑ **Mouse**
- ☑ **Touch Screen**
- ☑ **Track Ball**
- ☑ **Desktop**
- ☑ **PBX/KTS Telephone Set**

Computer Terminals and Moniters:

- ☑ **CAD**
- ☑ **NCIC**

Notes: N/A

Supervisor Position:# NO

- ☐ **CRT**
- ☐ **Mouse**
- ☐ **Touch Screen**
- ☐ **Track Ball**

Computer Terminals and Moniters:

- ☐ **CAD**
- ☐ **NCIC**
- ☐ **Security Video Monitor**
- ☐ **Logging Recorder**

- ☐ **Desktop**
- ☐ **PBX/KTS Telephone Set**
- ☐ **Radio**

Spare Position:# NO

- ☐ **CRT**
- ☐ **Mouse**
- ☐ **Touch Screen**
- ☐ **Track Ball**
- ☐ **Desktop**
- ☐ **Headset**
- ☐ **Footswitch**
- ☐ **PBX/KTS Telephone Set**
- ☐ **Radio**

- ☐ **DAT Tape Drive**

Notes: N/A

Computer Terminals and Moniters:

- ☐ **CAD**
- ☐ **NCIC**
- ☐ **Security Video Monitor**

Notes: N/A

Waveguide Entrance

Total Ports: 2

Ports Used: 2

Notes: Sealed PVC pipe is used to house RF transmission lines.

Microwave Equipment

Service: Digital

Manufacturer: Stratex

Model: DXR

Aligned Site: High Flat

Receive (MHz): 11176.250

Call Sign: WPXF776

Power: 24 VDC

Radio Configuration: Non-Protected

Transmit (MHz): 11666.250

Transmit Power: 28

FCC File No.:

MULTIPLEXER

Manufacturer: Megaplex

Model: 2104

Analog Channel Capacity:

Digital Channel Capacity: 1

ALARM SYSTEM

Yes

Microwave Notes: None.

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax / Waveguide

Length (ft):

Type:

Diameter (inches):

Jumper

Length (ft):

Type:

Diameter (inches):

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: Unknown at time of site survey.

Converter

Equipment ID: **Manufacturer:** **Model Number:**
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Self-Supporting	60	Unknown	No	No

Horizontal Cable Line Bridge
None.

Ladder
☑ Climbing ☐ Cable

Tower Climbing Ladder
Step bolts.

Tower Grounding System
Grounding ring (HALO) ?

Electrical System

EMERGENCY GENERATOR
Manufacturer:
Model Number:
Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator:

TRANSFER SWITCH
Manufacturer:
Model Number:
Voltage: 0
Ampere: 0
Electrical System Notes:

DISCONNECT SWITCH
☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM
The RF equipment room has adequate ground protection.

CHARGER
Manufacturer:
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Unknown	Yes.		

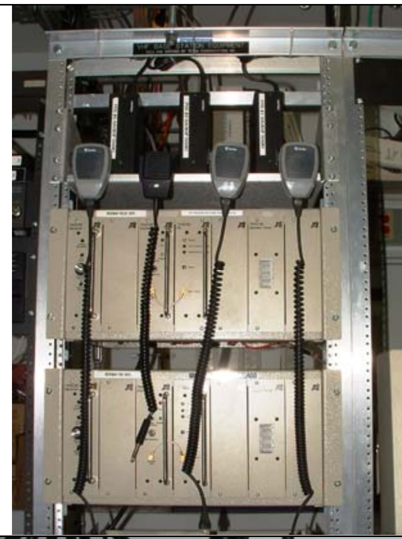
Description: Did not survey roof of building.

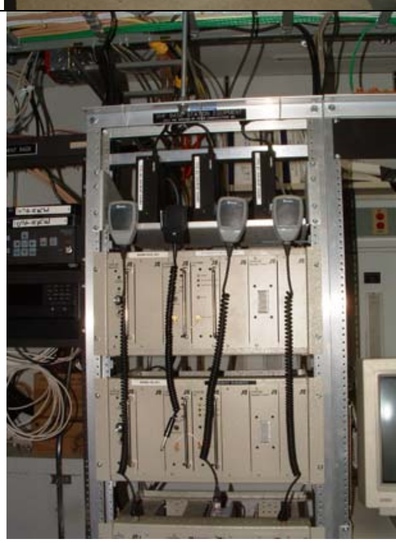
Bldg Entry: LMR and microwave entered the building through PVC pipe.

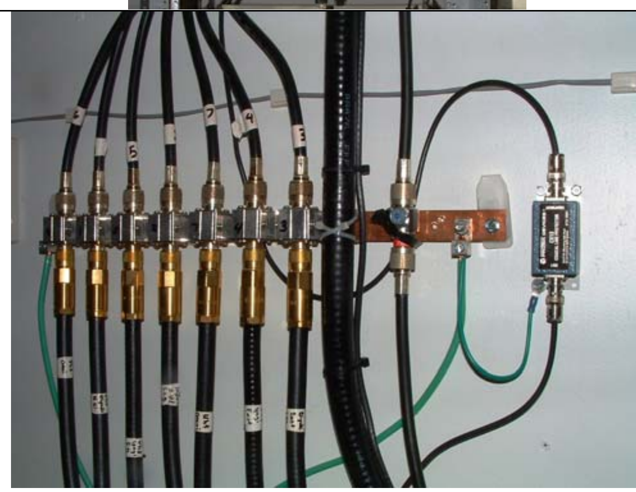
Notes: None.

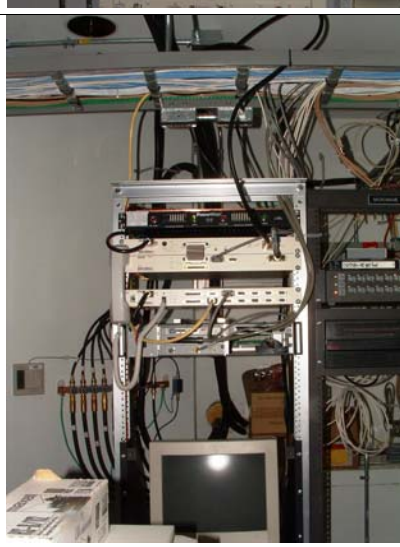
Site Name: 0109

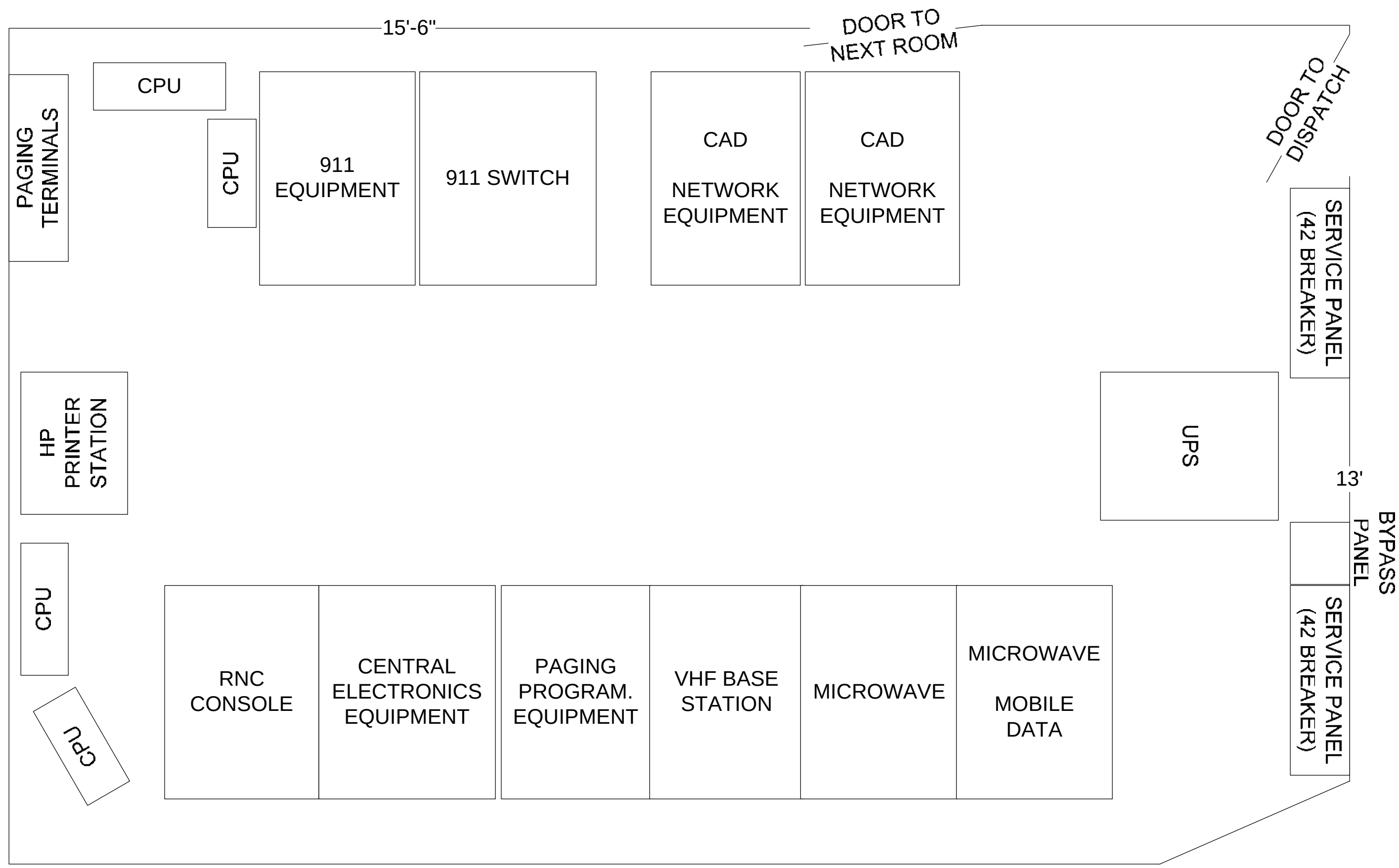
County Name: Gallatin











	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/5/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

COMMUNICATIONS
AN HSMM COMPANY
WWW.CTACOMMUNICATIONS.COM

CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT: SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE: RADIO EQUIPMENT LAYOUT
LAW & JUSTICE CENTER PSAP

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0109	N/A	1 OF 1

0111	Site Name		Site Type
	Andesite Mountain	**Site Contact**	**LMR**

Big Sky Resort - Andesite Mtn.,
Big Sky, Montana, 59729

Ben Hess
615 So. 16th Street
Bozeman, Montana 59715
(406) 582-2085

Survey Date 07/13/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.27355	111.39497

Site Access Requirements

Site access is through the Big Sky Ski resort by way of steep, dirt, rocky, winding roads. The radio equipment is located in the communications shelter.

Electric Utility N/A

Telephone Carrier N/A

Site Description

Site with ski lift equipment and buildings, communications shelter and tower. The tower is about one hundred feet up a hill covered by slide rock. This is a collocate site with Western Wireless as landlord.

Tower Description

Please refer to Tower Information. The tower is a 50 ft. monopole tower. There are eight two foot omni antennas mounted at the top of the tower and two, two foot omni antennas mounted at the 30 foot level of the tower.

Facility Grounding System

Possible buried ring grounding system (HALO)?

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

The shelter is a pre-fabricated shelter with peeble rock exterior. The shelter sets on a concrete and steel foundation.

Land Mobile Radio Equipment

Manufacturer: TAIT
Model:
Power:
Alarms:
Redundancy Configuration

Notes: Did not survey interior of communications shelter. The radio equipment is a TX/RX duplexer with battery backup.

Station Name: Gallatin Co. Paging
Remote Access

FREQUENCIES

Transmit (MHz): Unknown
Receive (MHz): Unknown
Transmit Power (watts): Unknown

Call Sign: Unknown
FCC File No:
Antenna Height (ft): 45

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft) 100'
Type Heliax
Diameter (inches) 7/8"

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: Fedders Unitary Products **Model Number:** W60CS10B1E11A

BTU: **Amperes:** **Voltage:** 208/230 **Phases:**

Description: Two units mounted on the rear of the shelter.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 12

Ports Used: 12

Notes: 4-1/2" O.D. sealed ports.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
Unknown				

Notes: Communications shelter interior was not surveyed.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: Communications shelter interior was not surveyed.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Monopole - Manufactured	50	Unknown	No	No

Horizontal Cable Line Bridge

Cable bridge length was about twelve feet long and was supporting transmissions lines over rocks from the tower to the communications shelter.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

Stepping bolts.

Tower Grounding System

Could not visually see the tower ground system due surrounding rocks at the tower base.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Did not survey the interior of communications shelter.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Not told of any building restrictions.		

Description: GPS antenna.

Bldg Entry: LMR enters the communications shelter from a twelve port entry plate mounted on the rear side of the shelter.

Notes: None.

Site Name: 0111
County Name: Gallatin






0201	**Site Name**		**Site Type**
	Kings Hill	**Site Contact**	**LMR**

White Sulfur Spring, Montana

Rick Seidlite
P.O. Box 449
White Sulphur Springs, Monta 59645
(406) 547-3397

Survey Date	**Surveyors**
03/30/2005	CMW, DRA

Observed Position (NAD83)

Latitude(N)	Longitude(W)
46.83836	110.71778

Site Access Requirements

Site access is through a paved road, US 89 into the Showdown Ski Area and parking lot. From the parking lot by ski mobile, up the ski slope, using snow shoes, into a wooded area. The tower and communications shelter were roped off from the skiing area.

Electric Utility Fergus Electric or Northwest Energy

Telephone Carrier N/A

Site Description

Skiing resort with lower building, building residing at the top of the ski slope, tower and communications shelter containing the radio equipment. There is also RF equipment for DOT and Great Falls Amatuer Radio Club (Contact Jimmie Cummings @ 452-1336).

Tower Description

Please refer to Tower Information. The tower is a 40 ft. guyed tower.

Facility Grounding System

Outside grounding system not surveyed due to snow.

Building Assessment

Wood building with green colored aluminum siding exterior, steel door, sheetrock walls, and concrete floor.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

There was a hole in the aluminum exterior back wall of the communications shelter.

Land Mobile Radio Equipment

Manufacturer: GE
Model: Mastro II
Power:
Alarms:
Redundancy Configuration
Notes: Tone 107.2
Station Name: DES Repeater
Remote Access

FREQUENCIES

Transmit (MHz):	155.025	**Call Sign:**	WPZR495
Receive (MHz):	158.775	**FCC File No:**	
Transmit Power (watts):	25	**Antenna Height (ft):**	29

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax		**Jumper**	
Length (ft)		**Length (ft)**	
Type		**Type**	
Diameter (inches)	3/4	**Diameter (inches)**	

CIRCUIT DUPLEXER

Name:

Duplexer Model: Telewave TPCD-1556

Notes: None.

Land Mobile Radio Equipment

Manufacturer: GE
Model: Mastro II
Power:
Alarms:
Redundancy Configuration
Notes: Tone 123.0
Station Name: Sheriff
Remote Access

FREQUENCIES

Transmit (MHz):	155.250	**Call Sign:**	WPZR495
Receive (MHz):	158.970	**FCC File No:**	
Transmit Power (watts):	25	**Antenna Height (ft):**	29

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax		**Jumper**	
Length (ft)		**Length (ft)**	
Type		**Type**	
Diameter (inches)	3/4	**Diameter (inches)**	

CIRCUIT DUPLEXER

Name:

Duplexer Model: Telewave TPCD-1556

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 7

Ports Used: 6

Notes: None.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Guyed	40	Unknown	No	No

Horizontal Cable Line Bridge
None.

Ladder
☑ Climbing ☐ Cable

Tower Climbing Ladder
None.

Tower Grounding System
Could not survey due to snow.

Electrical System

EMERGENCY GENERATOR

Manufacturer:
Model Number:
Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator:

TRANSFER SWITCH

Manufacturer:
Model Number:
Voltage: 0
Ampere: 0
Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Braided ground wire attached to coax from antenna coming into communications shelter and attached to ground flat bus bar. Antenna coax has connected polyphasers at the ground flat bus bar.

CHARGER

Manufacturer:
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: 10 Amperes.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No			Wooden.

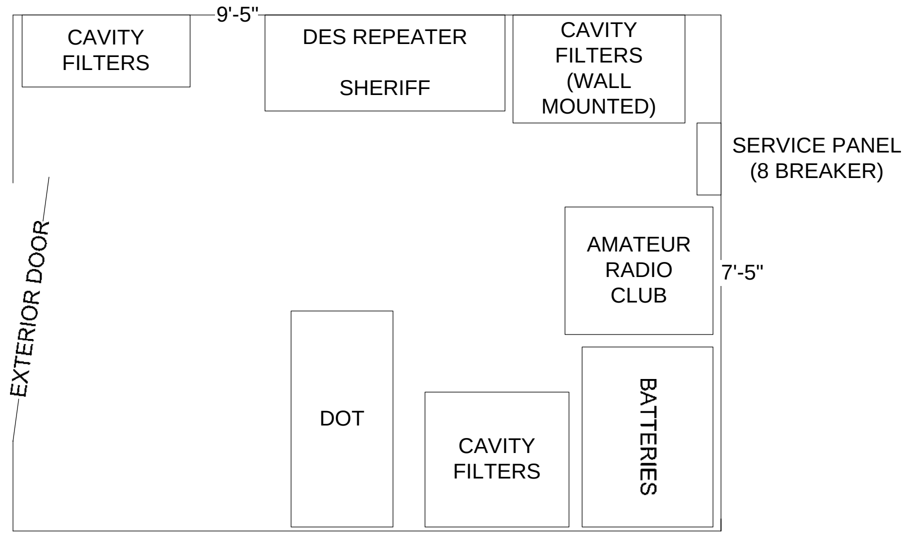
Description: None.

Bldg Entry: LMR enters the building through six holes.

Notes: None.

Site Name: 0201

County Name: Meagher



	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/8/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

COMMUNICATIONS
AN HSMM COMPANY
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CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
KINGS HILL

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0201	N/A	1 OF 1

0202	**Site Name**		**Site Type**
	Martinsdale Repeater	**Site Contact**	**LMR**

5.3 MI West, Martinsdale, Montana, 59053

Rick Seidlitz
P.O. Box 449
White Sulphur Springs, Monta 59645
(406) 547-3397

Survey Date	**Surveyors**
03/30/2005	CMW, DRA

Observed Position (NAD83)

Latitude(N)	Longitude(W)
46.44345	110.423083

Site Access Requirements

Site access is private owned ranch, Errol Galt - (406) 572-3312. Dirt roads, creeks, steep rocky hills. Accessed by use of ATV.

Electric Utility Northwest Energy

Telephone Carrier N/A

Site Description

Cinderblock building, utility poles and a wooden frame for antenna support is located on a mountainous hilltop site.

Tower Description

Please refer to Tower Information. The is no tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

Cinderblock 6-1/2' X 6', concrete floor, 6-1/2' wood ceiling, and wooden door.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MTR2000
Power:
Alarms:
Redundancy Configuration
Notes: Other equipment - 1 Ea. - Motorola Repeater Interface / 1 Ea. - 12X Filter / 1 Ea. - Power supply for UHF radio. This piece of equipment is not on FCC license WPZR495 at this location.
Station Name: Martinsdale Repeater - DPL 132
Remote Access

FREQUENCIES

Transmit (MHz):	155.025	**Call Sign:**	WPZR495
Receive (MHz):	158.775	**FCC File No:**	
Transmit Power (watts):	120	**Antenna Height (ft):**	15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Radius M1225
Power:
Alarms:
Redundancy Configuration
Notes: Other equipment - 1 Ea. - Motorola Repeater Interface / 1 Ea. - 12X Filter / 1 Ea. - Power supply for UHF radio. This piece of equipment is not on FCC license WPZR495 at this location.
Station Name: N/A (Paging) DPL 662
Remote Access

FREQUENCIES

Transmit (MHz): 458.700
Call Sign: Unknown
Receive (MHz): 453.700
FCC File No:
Transmit Power (watts): 45
Antenna Height (ft): 15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer:
Model Number:

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 2
Ports Used: 2
Notes: Transmission lines are in holes in brick.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Other - Wooden	54	N/A	No	N/A

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

N/A

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

One buried ground rod by wooden mast tied to Motorola cabinent frame.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Not informed of any.		Concrete and wood.

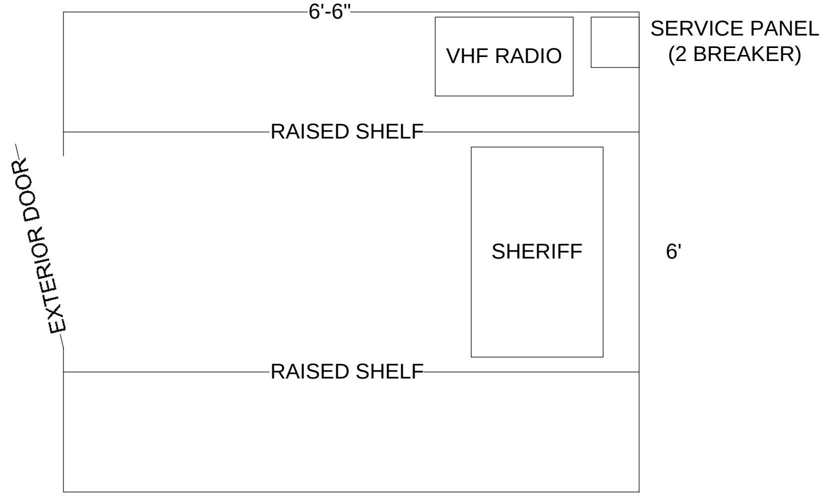
Description: None.

Bldg Entry: RF enters the building through several drilled holes.

Notes: None.

Site Name: 0202

County Name: Meagher



NAME		DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/8/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A
REVISION DATE('S):		

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20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
MARTINSDALE REPEATER

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0202	N/A	1 OF 1

0301	**Site Name**		**Site Type**
	Norris Hill Repeater	**Site Contact**	**LMR**
	Norris Hill 11 MI NNE, Ennis, MT 59729	Frank Ford P.O. Box 278 Virginia City, Montana 59755 (406) 843-4253	

Survey Date 04/06/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.49101	111.64486

Site Access Requirements

Site access is through field on privately owned ranch, through (2) two gates, uphill, mountainous dirt gravel roads. The tower and communications shelter are not contained.

Electric Utility Northwest Power

Telephone Carrier N/A

Site Description

Mountain top site with two towers, two buildings, and utility poles. Madison County equipment is located in the shelter along with miscellaneous equipment for Gallatin County site - High Flat (redundancy).

Tower Description

Please refer to Tower Information. The tower is a 40 ft self-supporting tower.

Facility Grounding System

Possible buried ring grounding system (HALO)? Braided wire attached to base of shelter bolts.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

The shelter is a pre-fabricated aluminum shelter with two (2) small windows and a steel base. The shelter is sitting on concrete slabs at each corner.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MSR2000
Power: UPS
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Norris Repeater (Sheriff)
Remote Access

FREQUENCIES

Transmit (MHz):	155.025	**Call Sign:**	WNRR222
Receive (MHz):	153.935	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	20

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model: DB4060-WOC-B

Notes: 4 Ea. transceiver duplexers.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: 2 Ea. TPI Corporation wall mounted heaters - Model #22R30-2 1 Ea. Carrier AC unit wall mounted.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
	Best Micro-Ferrups	ME3.1K	48	3.1

UPS Description: Four external mounted fans.

Waveguide Entrance

Total Ports: 6

Ports Used: 2

Notes: There are (4) four pipes in shelter wall to support coax cable runs. Presently there are no coax cables from these four (4) pipes. There is another entry point using a wall mounted junction box with two pipes. Coax cable is running from a single piece of sealed pipe in the junction box from the tower to the equipment.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Self-Supporting	50	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Tower is grounded with stranded wire to 2 tower legs, attached by clamps. Stranded wire is buried into the ground and is assumed at this point to be attached to a ground ring around the communications shelter (HALO).

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Grounds for the equipment in the shelter are two (2) tie rods buried into the ground with ground wire attached to the communications shelter in two (2) places. At the time of site visit, question of buried ground ring was asked but not confirmed.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		

Description: None.

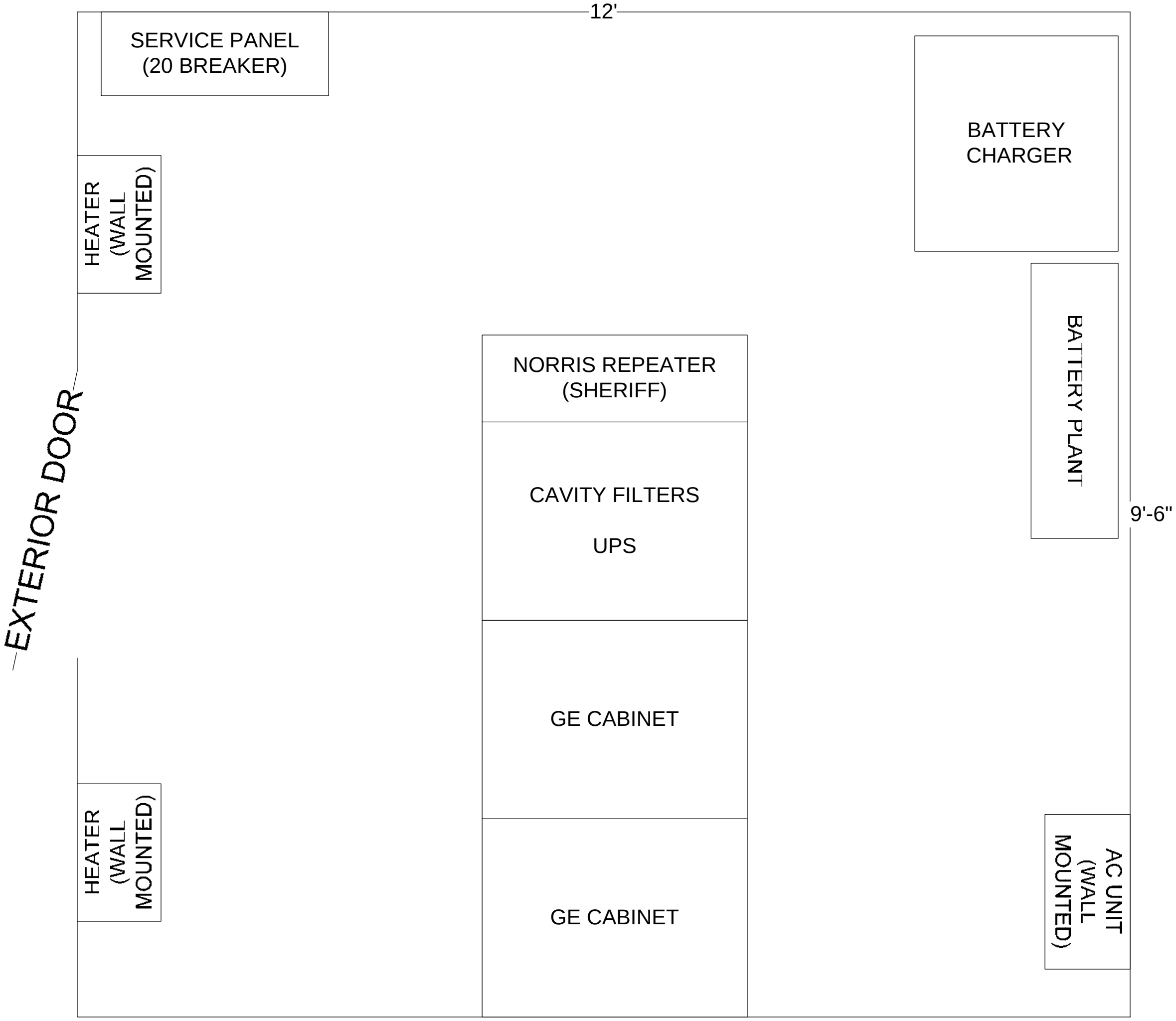
Bldg Entry: LMR enters the building through two pieces of pipe coming through an wall mount junction box.

Notes: Steel door with pad lock.

Site Name: 0301
County Name: Madison





NAME		DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/8/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A
REVISION DATE('S):		

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LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
NORRIS HILL

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0301	N/A	1 OF 1

0302	**Site Name**		**Site Type**
	Ruby Repeater	**Site Contact**	**LMR**

1 KM West of Snowcrest Ranch, Virginia City, MT 59755

Frank Ford
P.O. Box 278
Virginia City, Montana 59755
(406) 843-4253

Survey Date 04/06/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.09763	112.06986

Site Access Requirements

Site access is paved entrance to private owned ranch onto grassy field through two gates uphill.

Electric Utility Northwest Energy

Telephone Carrier N/A

Site Description

Private ranch. Freezer chest containing communications equipment and utility poles are located on an area of about 50 acres.

Tower Description

Please refer to Tower Information. There is no tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: MSR2000
Power: AC
Alarms:
Redundancy Configuration
Notes: RF equipment is located in a 48 in. X 30 in. X 32 in. freezer chest. Freezer chest is not locked.
Station Name: Ruby Repeater (Sheriff)
Remote Access

FREQUENCIES

Transmit (MHz): 155.025
Receive (MHz): 153.935
Transmit Power (watts): 100
Call Sign: WNRR222
FCC File No:
Antenna Height (ft): 35

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 1

Ports Used: 1

Notes: One hole drilled in back of freezer chest.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Pole - Wooden	25	N/A	No	N/A

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

N/A

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator:

TRANSFER SWITCH

Manufacturer:
Model Number:
Voltage: 0
Ampere: 0
Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

None.

CHARGER

Manufacturer:
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: None.

BATTERY PLANT

Manufacturer:
Model Number:
Ampere-Hour Rating: 0
Output Voltage: 0
Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		

Description: None.
Bldg Entry: LMR enters the chest through a drilled hole.
Notes: None.

Site Name: 0302

County Name: Madison






0303	Site Name		Site Type
	Virginia City Link	**Site Contact**	**LMR**

Alder Gulch Road, Virginia City, MT 59755

Frank Ford
P.O. Box 278
Virginia City, Montana 59755
(406) 843-4253

Survey Date	**Surveyors**
04/26/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.27362	111.95455

Site Access Requirements

Site access is through dirt road past mining operation site, uphill through rough wooded terrain area. The sites location overlooks the Virginia City area.

Electric Utility North Energy

Telephone Carrier 3 Rivers Telephone Cooperative

Site Description

Rocky hilltop area with building containing Madison County equipment, two towers, and another building with various antennas and a guyed antenna.

Tower Description

Please refer to Tower Information. The tower is a self-supporting 35 ft tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

Wood roof with particleboard siding, ply board flooring. Building sits on wood timbers.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer:
Model:
Power: AC
Alarms: No
Redundancy Configuration Yes
Notes: Tone 6SQ
Station Name: Sheriff
Remote Access No

FREQUENCIES

Transmit (MHz):	153.905	**Call Sign:**	WNRR222
Receive (MHz):	155.025	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	26

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer:
Model:
Power: AC
Alarms: No
Redundancy Configuration Yes
Notes: Tone 4A, 5B. Northern TeleCom Model # SCS-800 equipment is in the shelter that is being used for cellular application. FCC license KNKR312 is posted at the site.
Station Name: Sheriff
Remote Access No

FREQUENCIES

Transmit (MHz): 153.935 **Call Sign:** WNRR222
Receive (MHz): Simplex **FCC File No:**
Transmit Power (watts): 100 **Antenna Height (ft):** 26

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	Jumper
Length (ft)	Length (ft)
Type	Type
Diameter (inches)	Diameter (inches)

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer:
Model:
Power: AC
Alarms: No
Redundancy Configuration Yes
Notes: Tone 4A
Station Name: Sheriff
Remote Access No

FREQUENCIES

Transmit (MHz): 155.025 **Call Sign:** WNRR222
Receive (MHz): Simplex **FCC File No:**
Transmit Power (watts): 100 **Antenna Height (ft):** 26

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	Jumper
Length (ft)	Length (ft)
Type	Type
Diameter (inches)	Diameter (inches)

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 3

Ports Used: 2

Notes: 1 Ea., 2" to 2-1/4" PVC pipe sealed with silicon. Two holes drilled in ply board wall.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Self-Supporting	38	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Tower ground is one of three legs with a single wire to buried ground rod.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Tower grounding system is tie-rod burried in the ground and attached to single tower leg with a wire clamp. This wire also enters the building through a hole in the wall. Equipment cabinent being used for a shelf for an existing repeater has a single copper ground wire attached. Ground wire cable runs to contact point mounted on wall to coax from tower.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

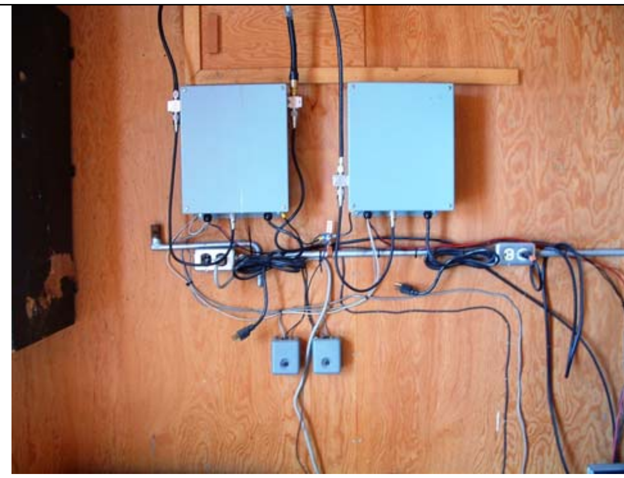
Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		Wooden 3/8 inch board.

Description: None.

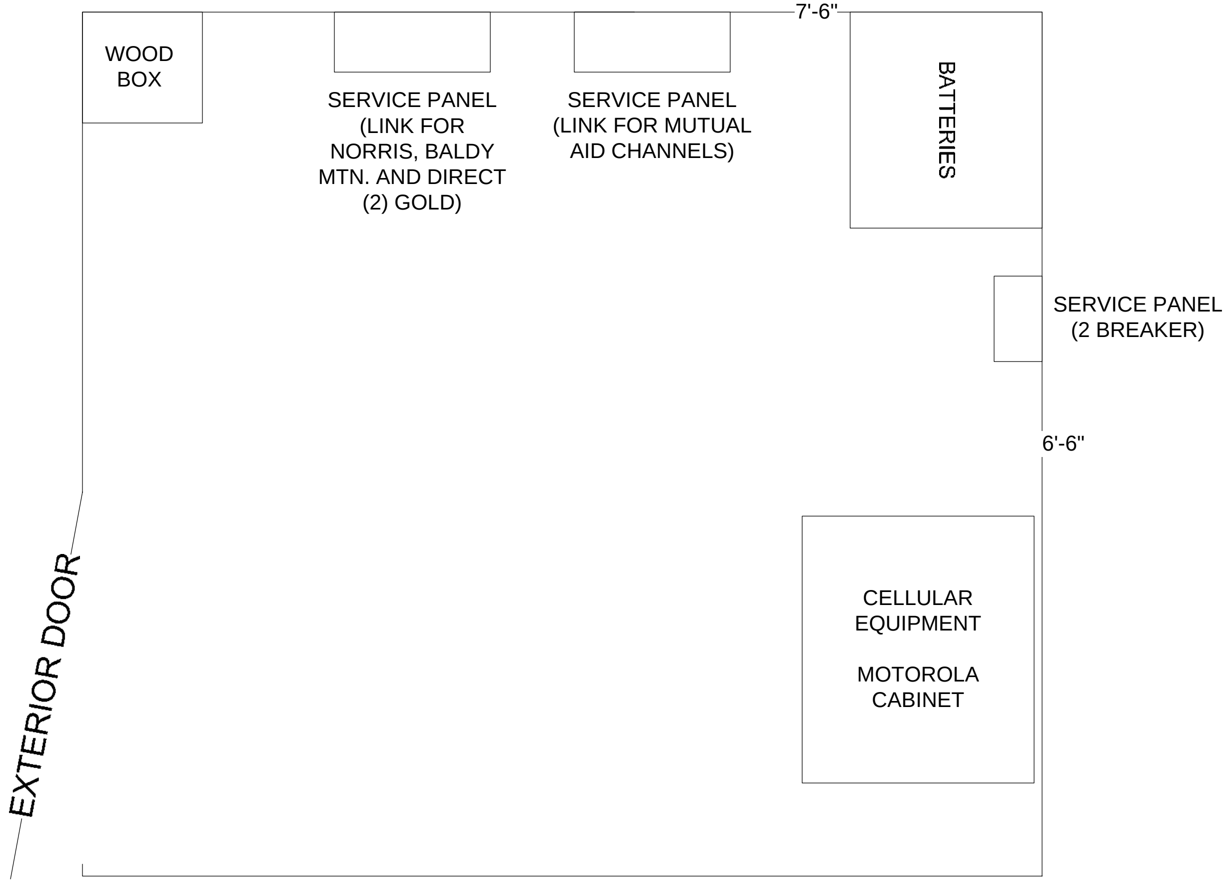
Bldg Entry: LMR enters the building through a piece of PVC pipe and one drilled hole on same side of building.

Notes: Wooden door with combination lock. There is a hole in the door.

Site Name: 0303
County Name: Madison





NAME		DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/8/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT: SCMIC INTEROPERABLE COMMUNICATIONS PLAN

TITLE: RADIO EQUIPMENT LAYOUT VIRGINIA CITY RADIO SITE

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0303	N/A	1 OF 1

0305	**Site Name**		**Site Type**
	Baldy Repeater	**Site Contact**	**LMR**

Off SR-287 and Alder Gulch Road, Virginia City, Montana, 59755

Frank Ford
P.O. Box 278
Virginia City, Montana 59755
(406) 843-4253

Survey Date	**Surveyors**
07/15/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.19546	111.92425

Site Access Requirements

Site access is through woods, mountain trails.

Electric Utility None

Telephone Carrier None

Site Description

Wood communications shelter, two towers, and a roof mounted solar panel assembly surrounded by trees in a grassy area.

Tower Description

Please refer to Tower Information. There are two 25 ft. self-supporting towers. The towers and the solar panel assembly are mounted together. The towers on the sides of the shelter and the solar panels are in the middle mounted across the shelter.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

Wooden shelter, sturdy built, with 36" inch steel door.

Land Mobile Radio Equipment

Manufacturer: GE
Model: MASTR II
Power:
Alarms:
Redundancy Configuration
Notes: Site is 100 percent solar powered.
Station Name: Highway Patrol
Remote Access

FREQUENCIES

Transmit (MHz):	154.680	**Call Sign:**	Unknown
Receive (MHz):	155.460	**FCC File No:**	
Transmit Power (watts):	50	**Antenna Height (ft):**	N/A

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: LMR equipment information was obtained after site survey.

Land Mobile Radio Equipment

Manufacturer: GE
Model: MASTR II
Power:
Alarms:
Redundancy Configuration
Notes: Site is 100 percent solar powered.
Station Name: Sheriff
Remote Access

FREQUENCIES

Transmit (MHz): 155.025
Call Sign: Unknown
Receive (MHz): 153.935
FCC File No:
Transmit Power (watts): 50
Antenna Height (ft): N/A

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: LMR equipment information was obtained after site survey.

Land Mobile Radio Equipment

Manufacturer: Daniels
Model:
Power:
Alarms:
Redundancy Configuration
Notes: Site is 100 percent solar powered.
Station Name: BLM (Bureau of Land Management)
Remote Access

FREQUENCIES

Transmit (MHz): 168.425
Call Sign: Unknown
Receive (MHz): 167.900
FCC File No:
Transmit Power (watts): Unknown
Antenna Height (ft): N/A

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: LMR equipment information was obtained after site survey.

Heating, Ventilation and Air Conditioning

Manufacturer:
Model Number:

BTU:	Amperes:	Voltage:	Phases:

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 3

Ports Used: 2

Notes: Exterior holes are sealed around transmission lines.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number:	Manufacturer:	Model:

Notes: None.

Converter

Equipment ID:	**Manufacturer:**	**Model Number:**
Amperes:	**Fuse Positions:**	
Output Voltage	**Voltage:**	

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
Rohn	Guyed	20	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Ground rods tied together.

Tower Information

Manufacturer	**Type**	**Tower Height (ft)**	**FCC Registration Number**	**FAA Lighting**	**FAA Paint**
Rohn	Guyed	20	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☒ Climbing ☒ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Grounding rods tied together.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Grounding information was obtained after site survey. Single point stud ground attached to tower grounds.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer: Trace

Model Number:

Ampere-Hour Rating: 40

Output Voltage: 0

Notes: 2 Each

Roof Top Tower Information

Roof Top	**Bldg Restrict**	**Roof Surface**	**Roof Surface Description**
Yes	Not informed of any.		Roll roofing over wood and

plyboard.

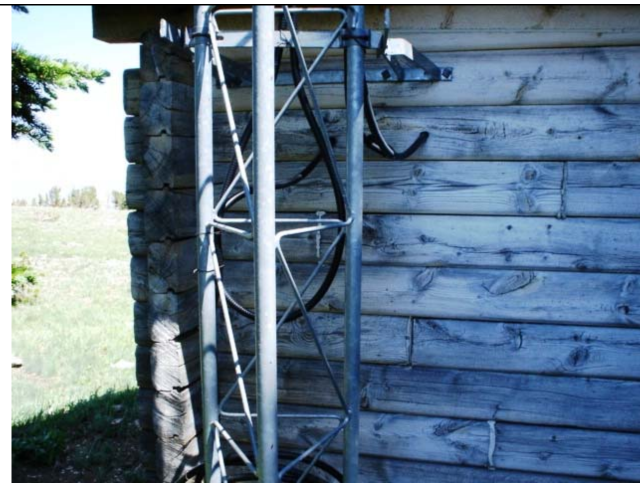
Description: Solar panels assembly, one 10 ft. omni mounted to a 6 ft. mounting bracket assembly exist on the roof of the communications shelter.

Bldg Entry: LMR enters the building through the back wall of the shelter.

Notes: Roll roofing is damaged in some places and needs repairing or replacing.

Site Name: 0305

County Name: Madison



0401	Site Name		Site Type
	North Hill	**Site Contact**	**LMR**

Off (N) C Street, Livingston, Montana, 59047

Frank Smith
414 E. Callender
Livingston, Montana 59047
(406) 222-4108

Survey Date	**Surveyors**
03/31/2005	CMW, DRA

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.67392	110.56738

Site Access Requirements

Site access is off of paved street onto steep, uphill, dirt, gravel, rocky path. The tower and communications shelter are located at the top.

Electric Utility NorthWestern Energy

Telephone Carrier Quest

Site Description

Rocky hilltop site with towers, communications shelter, and utility poles.

Tower Description

Please refer to Tower Information. The tower is a guyed 28 ft. tower.

Facility Grounding System

15' deep steel channel buried down into concrete.

Building Assessment

None.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

Concrete block with concrete and brick exterior. Wood, tin roof and a steel door.

Land Mobile Radio Equipment

Manufacturer: GE
Model: Mastr III
Power: 250 V AC
Alarms:
Redundancy Configuration No
Notes: South Tone 118.8, North Tone 114.8, Dispatch access to North and South repeater.
Station Name: Rural Fire
Remote Access Yes - 2 Pairs

FREQUENCIES

Transmit (MHz): 154.160
Receive (MHz): Simplex
Transmit Power (watts): 100
Call Sign: WNJR361
FCC File No:
Antenna Height (ft): 15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Land Mobile Radio Equipment

Manufacturer: GE
Model: Mastr III
Power:
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Park County Law Enforcement
Remote Access

FREQUENCIES

Transmit (MHz): 155.595 | **Call Sign:** WRL678
Receive (MHz): Simplex | **FCC File No:**
Transmit Power (watts): 100 | **Antenna Height (ft):** 15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**
BTU: **Amperes:** **Voltage:** **Phases:**
Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 1
Ports Used: 1
Notes: Holes in wall.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
Rohn	Guyed	28	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Unknown

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Three aught ring about 3 inches high. Everything is tied to it. Attached to utility pole is channel steel with braided wire and other ground wire. The utility pole is buried 15 ft. deep into the rock.

CHARGER

Manufacturer: M/A-COM

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 750

Output Voltage: 0

Notes: Batteries are dead.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		Wood, tin roof.

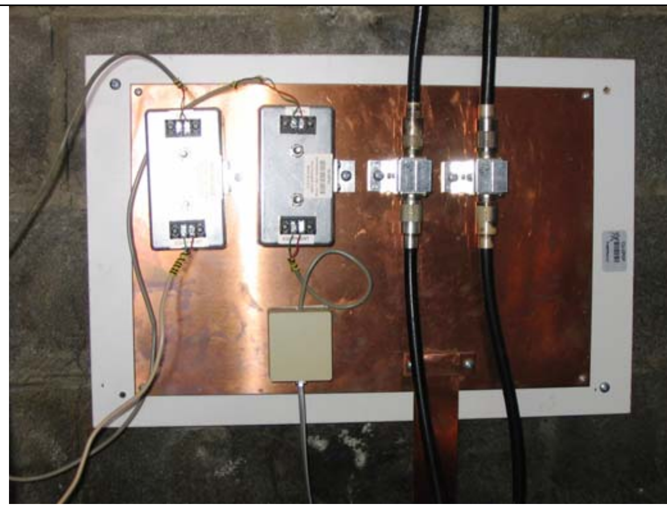
Description: None.

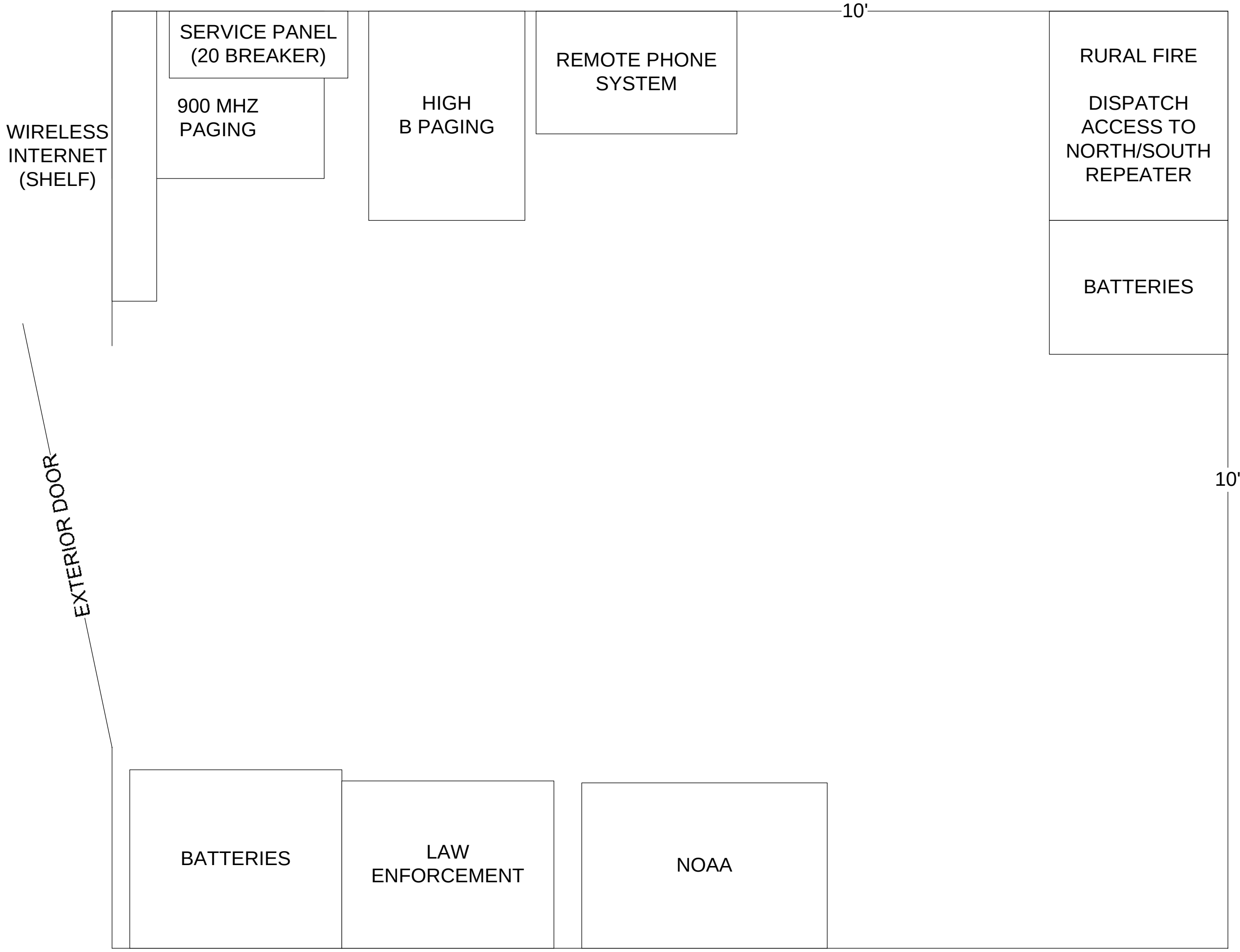
Bldg Entry: LMR enters the building through holes in the concrete.

Notes: None.

Site Name: 0401

County Name: Park





	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/8/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

COMMUNICATIONS
AN HSMM COMPANY
WWW.CTACOMMUNICATIONS.COM

CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
NORTH HILL

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0401	N/A	1 OF 1

0402	**Site Name**		**Site Type**
	North Repeater	**Site Contact**	**LMR**

Off Old Flat Head Road,
Wilsall, Montana, 59086

Frank Smith
414 E. Callender
Livingston, Montana 59047
(406) 222-4105

Survey Date **Surveyors**
03/31/2005 CMW, DRA

Observed Position (NAD83)

Latitude(N) 45.99295
Longitude(W) 110.67364

Site Access Requirements

Site access is through paved road to dirt, curvey, uphill road through a barbed wire fence.

Electric Utility Park Electric

Telephone Carrier N/A

Site Description

Flat, dirt, sagebrush, hilltop site with communications shelter and utility pole with antenna.

Tower Description

Please refer to Tower Information. The is no tower

Facility Grounding System

Single wire around building attached to two grounding rods at two corners of the building.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

The shelter has aluminum siding and roof. The shelter is sitting on 2 X 6 wood timbers. There are bullet holes visible on the exterior of the shelter

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: DeskTrack
Power: AC
Alarms:
Redundancy Configuration
Notes: Could not locate FCC license.
Station Name: North Repeater
Remote Access No

FREQUENCIES

Transmit (MHz): 154.415
Receive (MHz): 158.835
Transmit Power (watts): 40

Call Sign: Unknown
FCC File No:
Antenna Height (ft): 11

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name: CELWAVE
Duplexer Model: TDD-7300A
Notes: 3db Omni-Directional antenna.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 1

Ports Used: 1

Notes: Hole in the plywood wall.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Pole - Wooden	40	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Antenna grounding is single shielded cable from antenna down pole into a polyphaser. Cable from polyphaser is through building to equipment.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Grounding system is 3/16" solid copper wire to one ground rod.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		Aluminum, trays bolted down.

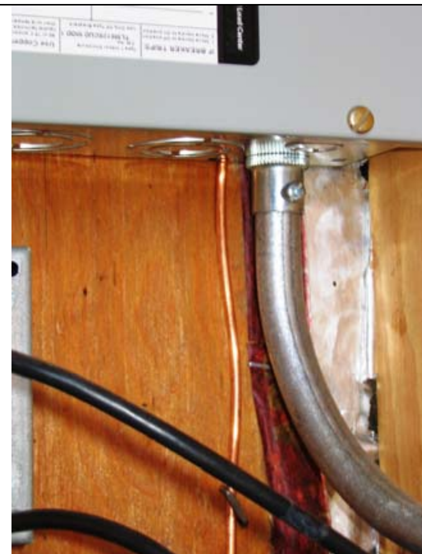
Description: None.

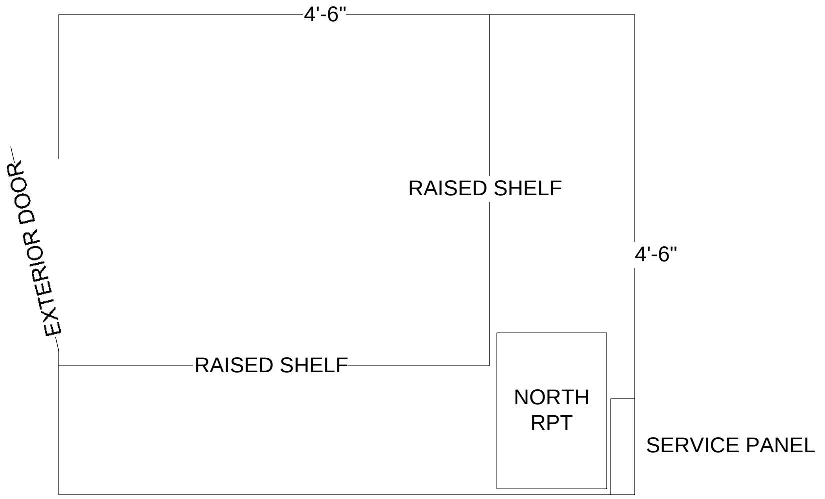
Bldg Entry: LMR entes the communications shelter through a hole in the plywood wall.

Notes: 38 inch wide door has bullet hole visible on the exterior. Combination lock on door. Combination is 1900.

Site Name: 0402

County Name: Park





NAME		DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/8/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A
REVISION DATE('S):		

CTA COMMUNICATIONS
AN HSMM COMPANY
WWW.CTACOMMUNICATIONS.COM

CTA COMMUNICATIONS, INC.
20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT: SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE: RADIO EQUIPMENT LAYOUT
NORTH REPEATER

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0402	N/A	1 OF 1

0403	**Site Name**		**Site Type**
	Paradise Valley Fire Dept	**Site Contact**	**LMR**

Off Chico Cemetery Road,
Emigrant, Montana, 59065

Frank Smith
414 E. Callender
Livingston, Montana 59047
(406) 222-4108

Survey Date	Surveyors
03/31/2005	CMW, DRA

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.35987	110.71792

Site Access Requirements

Off of paved road into the parking lot of the Emigrant Rural Firestation.

Electric Utility N/A

Telephone Carrier N/A

Site Description

Site is Emigrant Rural Firestation. The site is on a large area of property that contains the building, tower, and a gravel front parking lot.

Tower Description

Please refer to Tower Information. The tower is a self-supporting 38 ft. tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

Ridged metal construction with four bay doors and single entrance doors in the front and rear.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Radius GM300
Power: AC
Alarms:
Redundancy Configuration
Notes: This site was surveyed again on 07/14/2005. 115 volt AC Pyramid Gold Series regulated power supply Model# PS-21K
Station Name: South Repeater
Remote Access

FREQUENCIES

Transmit (MHz):	154.190	**Call Sign:**	WPGM864
Receive (MHz):	Simplex	**FCC File No:**	
Transmit Power (watts):	90	**Antenna Height (ft):**	N/A

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: Kenwood
Model: TKR-850
Power:
Alarms:
Redundancy Configuration
Notes: Did not survey.
Station Name: South Repeater
Remote Access

FREQUENCIES

Transmit (MHz): 154.415
Receive (MHz): Simplex
Transmit Power (watts): 45
Call Sign: WPTT384
FCC File No:
Antenna Height (ft): 43

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Did not visually see HVAC equipment.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 0

Ports Used: 0

Notes: Did not visually see.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: Did not survey.

Tower Information

Manufacturer	**Type**	**Tower Height (ft)**	**FCC Registration Number**	**FAA Lighting**	**FAA Paint**
Rohn	Self-Supporting	38	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Tower grounding is coax cable from antenna to a polyphaser. Cable from tower is attached to a buried grounding rod.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Did not observe or was told about any grounding system during site survey.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		

Description: None

Bldg Entry: LMR enters the building through a hole in the exterior of the back of the building.

Notes: There is a locking mechanism at the front door.

Site Name: 0403

County Name: Park

0404	**Site Name**		**Site Type**
	Cooke City Repeater	**Site Contact**	**LMR**

Off Miller Road, Gardiner, Montana, 59030

Frank Smith
414 E. Callender
Livingston, Montana 59047
(406) 222-4108

Survey Date 07/14/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.03080	109.94698

Site Access Requirements

Site access is through Cooke city up steep, winding, dirt roads into thick forest area through gulleys, crossing streams.

Electric Utility N/A

Telephone Carrier N/A

Site Description

Forest, mountain top site with communications shelter, pole mounted solar panels, and three towers with antenna's surrounded by woods, hills, and valleys on a steep incline.

Tower Description

Please refer to Tower Information. The tower is a 40 ft. guyed tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

The shelter is made of wood and aluminum T-Ribbed siding and roof.

Land Mobile Radio Equipment

Manufacturer:

Model:

Power: Unknown

Alarms: Unknown

Redundancy Configuration Unknown

Notes: No survey of the interior of the communications shelter. Park County Sheriffs Department and Cooke City Search and Rescue use these frequencies per our facility contact.

Station Name: SAR RPT

Remote Access Unknown

FREQUENCIES

Transmit (MHz):	153.830	**Call Sign:**	Unknown
Receive (MHz):	154.445	**FCC File No:**	
Transmit Power (watts):	Unknown	**Antenna Height (ft):**	Unknown

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Did not survey interior of shelter.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: Did not survey interior of shelter.

Waveguide Entrance

Total Ports:

Ports Used:

Notes: Did not survey the interior of the shelter. Transmission lines from the tower went down into rocks.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
Unknown				

Notes: Communications shelter interior was not surveyed.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: Communications shelter interior was not surveyed.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Guyed	40	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Single wire rapped around the tower legs.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Did not visually see any grounding on the exterior of the communications shelter.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		Wood covered with Aluminum T-Ribbed siding.

Description: None.

Bldg Entry: Did not visually see where LMR entered the shelter.

Notes: Key lock entry door had a 2 X 4 cross brace to prevent entry into shelter.

Site Name: 0404
County Name: Park






0405	**Site Name**		**Site Type**
	Colter Repeater	**Site Contact**	**LMR**

Off Lulu Pass Trail Road,
Gardiner, Montana, 59030

Frank Smith
414 E. Callender
Livingston, Montana 59047
(406) 222-4108

Survey Date 07/14/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.02806	109.90116

Site Access Requirements

Site access is through Cooke City onto dirt road that is currently in a construction zone. The tower and communications shelter are located in a grassy area.

Electric Utility N/A

Telephone Carrier N/A

Site Description

Site with communications shelter, tower, miscellaneous shelter, construction equipment, and other vehicles. The radio equipment is located in the shelter.

Tower Description

Please refer to Tower Information. The tower is a 35 ft. self-supporting tower. Antenna's on the tower are a 10 ft. omni at the top, 6 ft. omni side mounted, and a yagi style antenna.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

The shelter is a wooden A-frame building.

Land Mobile Radio Equipment

Manufacturer:
Model:
Power:
Alarms:
Redundancy Configuration Unknown

Notes: No survey of the interior of the communications shelter. Park County Sheriffs Department, Cooke City Search and Rescue, and the Cooke City Volunteer Fire Department use these frequencies per our facility contact.

Station Name: YNP RPT

Remote Access Unknown

FREQUENCIES

Transmit (MHz): 166.975
Call Sign: Unknown
Receive (MHz): 166.375
FCC File No:
Transmit Power (watts): Unknown
Antenna Height (ft): 45

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax
Length (ft)
Type
Diameter (inches)

Jumper
Length (ft)
Type
Diameter (inches)

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Did not survey interior of shelter.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: Did not survey interior of shelter.

Waveguide Entrance

Total Ports: 0

Ports Used: 0

Notes: Did not visually see entry ports into the shelter.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
Unknown				

Notes: Communications shelter interior was not surveyed.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: Communications shelter interior was not surveyed.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Self-Supporting	35	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Each leg of tower has clamped braided wire that runs down into a rectangular concrete pad. Tower could be tied into buried ring grounding system (HALO).

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Did not survey the interior of communications shelter.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Not informed of any.		Wood and tin roofing.

Description: A 16 ft. omni antenna and a 16 inch solar panel attached to the roof.

Bldg Entry: LMR could be entering the building from the tower where a panel with a pipe running down into the concrete pad could be carrying the transmission lines underground into the building.

Notes: None.

Site Name: 0405

County Name: Park

0406	**Site Name**		**Site Type**
	Meyers Flats	**Site Contact**	**LMR**

Off Hwy 89, Livingston, Montana, 59047

Frank Smith
414 E. Callender
Livingston, Montana 59047
(406) 222-4108

Survey Date	**Surveyors**
07/14/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.59750	110.54713

Site Access Requirements

Site access is ten miles through rocky, dirt, curvy roads from a private ranch off of highway 89 in Livingston.

Electric Utility Unknown

Telephone Carrier Unknown

Site Description

Site is on a private ranch that has two communications shelters, four towers, and a private building. Verizon has a fenced in communications shelter and a tower on a hill below the site.

Tower Description

Please refer to Tower Information. The tower is a 50 ft. guyed tower. There were fifteen or more antennas and a microwave dish mounted on the tower.

Facility Grounding System

Possible buried ring grounding system (HALO)?

Building Assessment

N/A

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

Shelter has concrete walls, roof, and foundation. There is a problem of water leakage. There are pieces of welded steel flat bar at some of the joints of the interior walls being used to anchor the shelter sections.

Land Mobile Radio Equipment

Manufacturer: GE
Model: MASTR II
Power: AC
Alarms: Unknown
Redundancy Configuration Unknown
Notes: Miscellaneous equipment: Zetron Model 38 A repeater panel; Uniden Force Repeater/Radio There was another GE MASTR II present which was not powered on. Did not obtain antenna type or height during site survey.
Station Name: White (Hospital)
Remote Access Unknown

FREQUENCIES

Transmit (MHz):	464.175	**Call Sign:**	WNHA318
Receive (MHz):	469.175	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	Unknown

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 10

Ports Used: 10

Notes: Drilled holes with pipe running through wall carries coax cable from tower to equipment in communications shelter.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
Rohn	Guyed	50	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

One tower leg has a single ground wire that is connected to a buried ground rod. The other two tower legs have a attached single ground wire that runs into the ground.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Single copper ground wire running from 100 watt transmitter back to the coax at the port entry hole. Also electrical outlet is wrapped with copper wire that runs into the wall.

CHARGER

Manufacturer:	M/A-COM
Model Number:	
Amperes:	0
Fuse Positions:	0
Input Voltage:	0
Output Voltage:	0
Notes:	Built into MASTR II cabinets.

BATTERY PLANT

Manufacturer:	
Model Number:	
Ampere-Hour Rating:	0
Output Voltage:	0
Notes:	Case contains three batteries. Case is insulated with styrofoam and is connected to an electrical wall panel.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		Roof is made of concrete. Concrete is broken in several places.

Description: None.

Bldg Entry: LMR enters the building through ten drilled holes.

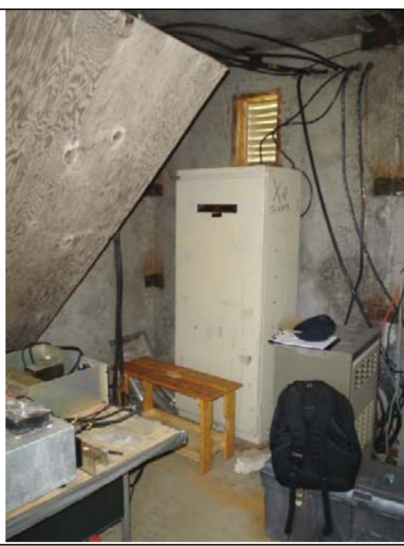
Notes: None.

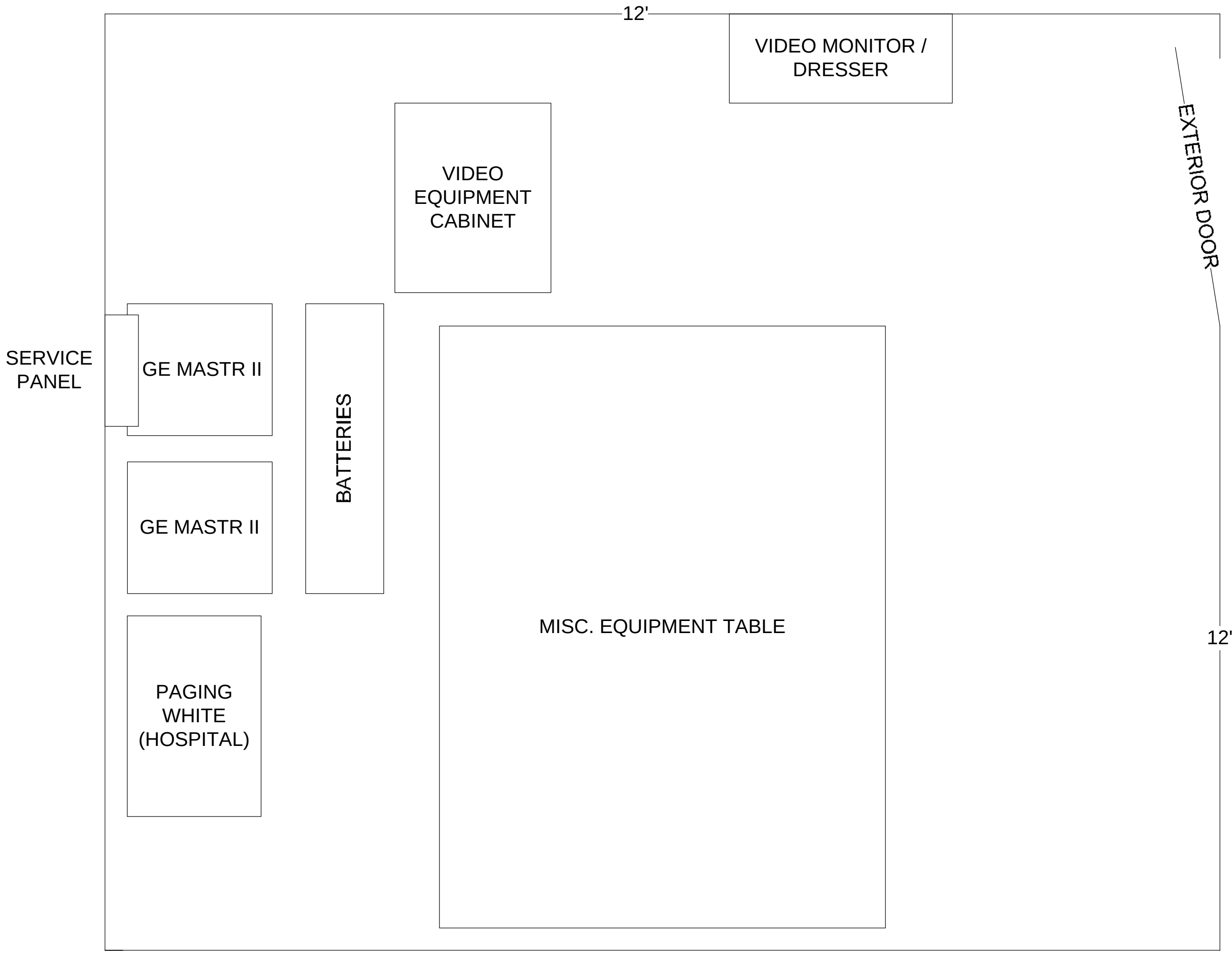
Site Name: 0406

County Name: Park







NAME		DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/9/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A
REVISION DATE('S):		

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20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
MEYERS FLATS

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0406	N/A	1 OF 1

0501	**Site Name**		**Site Type**
	Sweet Grass Airport	**Site Contact**	**LMR**

Airport Road, Big Timber, Montana, 59011

Kerry O'Connell
P.O. Box 567
Big Timber, Montana 59011
(406) 932-5143

Survey Date 04/01/2005

Surveyors CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.81103	109.97554

Site Access Requirements

Site access is paved airport entrance to grass, rocky area beyond the landing strip.

Electric Utility Northwest Energy

Telephone Carrier Unknown

Site Description

The site is located at one end of the Big Timber Airport in a grass, rocky area. There is a building that houses the communications equipment, a tower, and an outside electrical panel located nearby. There is miscellaneous equipment around the building and tower area. Wire fencing with wooden poles run along the rear of the property where the building and tower are located.

Tower Description

Please refer to Tower Information. The tower is a 50 ft. self-supporting tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

A-frame, wood building used also as the Forest Service shed. Birds have accessed the building through hole. The building has one door entrance. The exterior paint has peeled off and windows have been boarded up.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

None.

Land Mobile Radio Equipment

Manufacturer: M/A-Com
Model: Mastr III
Power: 250 VAC
Alarms: No
Redundancy Configuration
Notes: Trips Monument site repeater. Tone 131.8. Equipment cabinet is very dusty. Back compartment is exposed due to coax cable running through cabinet door.
Station Name: Sweet Grass Monument Repeater
Remote Access

FREQUENCIES

Transmit (MHz): 154.980
Call Sign: WPTQ340
Receive (MHz): 158.895
FCC File No:
Transmit Power (watts): 40
Antenna Height (ft): 55

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: None.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 6

Ports Used: 6

Notes: Drilled holes in wall. Cables are tie wrapped to hooks.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
	Self-Supporting	50	Unknown	Yes	Yes

Horizontal Cable Line Bridge

None.

Ladder

☑ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Tower grounding system is not visible at this site.

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Single copper wire attached to LMR equipment.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		Wood, metal.

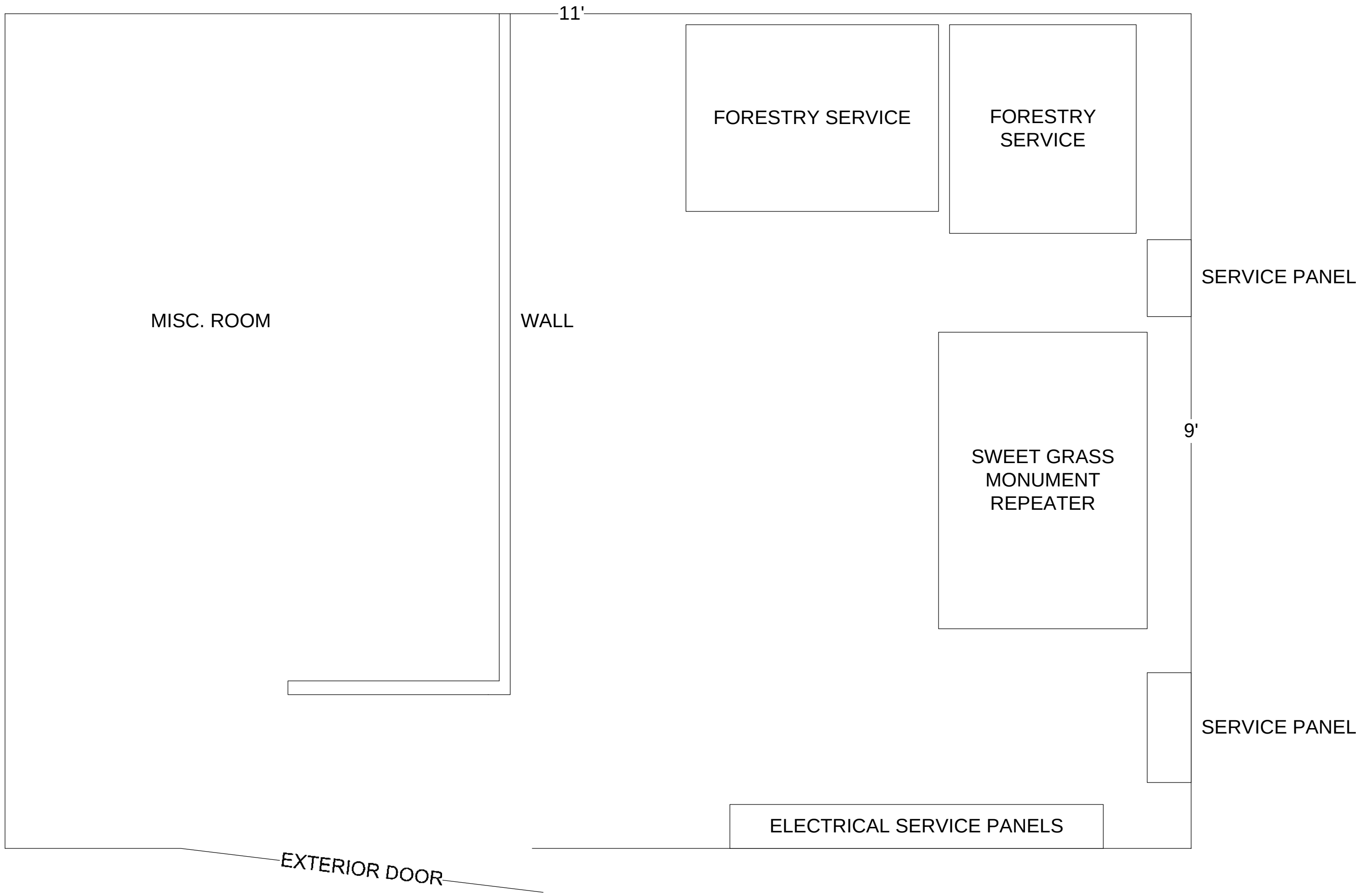
Description: None.

Bldg Entry: LMR enters the building through three holes.

Notes: None.

Site Name: 0501

County Name: Sweet Grass



	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/9/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT: SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE: RADIO EQUIPMENT LAYOUT
SWEET GRASS AIRPORT

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0501	N/A	1 OF 1

0502	Site Name		Site Type
	So Office Courthouse	**Site Contact**	**LMR**

P.O. Box 567, Big Timber, Montana, 59011

Kerry O'Connell
P.O. Box 567
Big Timber, Montana 59011
(406) 932-5143

Survey Date	**Surveyors**
04/01/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.83409	109.95801

Site Access Requirements

Site access is using local paved streets to Sweet Grass Courthouse. The tower and communications equipment is located at the courthouse.

Electric Utility Northwest Energy

Telephone Carrier Triangle Telepone - Havor

Site Description

Two story brick building located on a local street that serves as a courthouse, sheriffs department, and dispatch operations. There is a parking lot located on the West side of the building and also in the rear.

Tower Description

Please refer to Tower Information. The tower is a guyed 25 ft. tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

This is a two story brick building. There is radio equipment in a small room located near a rear entrance to the building. Other equipment and dispatching is located in a small office area.

Communication Shelter Manufacturer/Model

N/A N/A

Communication Shelter Notes:

There is no communications shelter located at this site.

Land Mobile Radio Equipment

Manufacturer: M/A-COM
Model: MASTR III
Power: 250 VAC
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Sweet Grass County Dispatch
Remote Access

FREQUENCIES

Transmit (MHz):	154.040	**Call Sign:**	KNIA830
Receive (MHz):	155.805	**FCC File No:**	
Transmit Power (watts):	110	**Antenna Height (ft):**	39

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: M/A-COM
Model: MASTR III
Power: 250 VAC
Alarms:
Redundancy Configuration
Notes: None.
Station Name: Sweet Grass Law Repeater
Remote Access

FREQUENCIES

Transmit (MHz):	154.800	**Call Sign:**	KNIA831
Receive (MHz):	158.730	**FCC File No:**	
Transmit Power (watts):	110	**Antenna Height (ft):**	39

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer: M/A-COM
Model: MASTR III
Power: 250 VAC
Alarms:
Redundancy Configuration
Notes: None.
Station Name: DES
Remote Access

FREQUENCIES

Transmit (MHz):	155.820	**Call Sign:**	KNIA830
Receive (MHz):	Simplex	**FCC File No:**	
Transmit Power (watts):	110	**Antenna Height (ft):**	39

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: HVAC unit was located on the back side of the courthouse.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 3

Ports Used: 3

Notes: Holes drilled at the back of the courthouse. Not sealed.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
Rohn	Guyed	25	Unknown	No	No

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

Unknown

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

No visible grounding at this site.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: None.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Not informed of any.		

Description: Tower and LMR antennas are installed on the building roof.

Bldg Entry: LMR enters the building through three drilled holes.

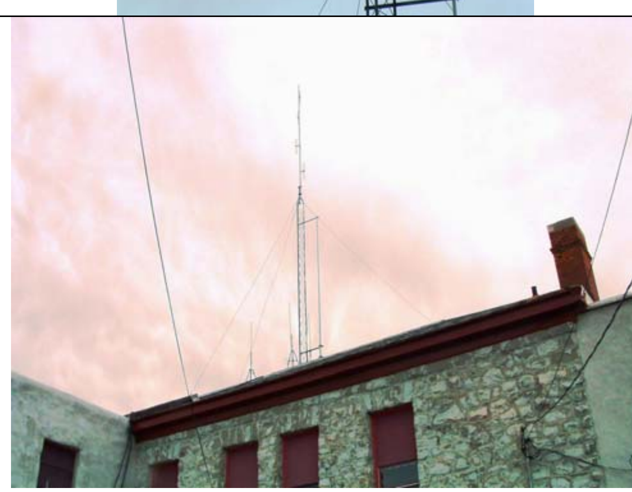
Notes: None.

Site Name: 0502

County Name: Sweet Grass





0503	**Site Name**		**Site Type**
	Tin Can Hill	**Site Contact**	**LMR**

Off Rapelje Road, Big Timber, Montana, 59011

Kerry O'Connell
P.O. Box 567
Big Timber, Montana 59011
(406) 932-5143

Survey Date	**Surveyors**
04/01/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.89445	109.85758

Site Access Requirements

Site access is uphill gravel road of of paved road into flat, grassy hilltop.

Electric Utility Northwest Energy

Telephone Carrier Triangle Telephone

Site Description

The communications shelter and tower is located on hilltop off of SR-478 and Rapelje Rd. The site contains other towers and buildings.

Tower Description

Please refer to tower information. The tower is a guyed 100 ft. tower.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

Communication Shelter Notes:

The communications shelter is cinderblock, concrete flooring, sheetrock ceiling, steel door, wood roof with shingles.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar
Power: 100
Alarms: No
Redundancy Configuration No
Notes: VHF, 100 watts, P25 compatible.
Station Name: Sweet Grass Co. Dispatch
Remote Access No

FREQUENCIES

Transmit (MHz):	154.040	**Call Sign:**	KNIA830
Receive (MHz):	155.805	**FCC File No:**	
Transmit Power (watts):	100	**Antenna Height (ft):**	15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	**Jumper**
Length (ft)	**Length (ft)**
Type	**Type**
Diameter (inches)	**Diameter (inches)**

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: Filter system, cavity system.

Land Mobile Radio Equipment

Manufacturer: Motorola
Model: Quantar
Power: 100 watts
Alarms: No
Redundancy Configuration No
Notes: VHF, 100 watts, P25 compatible.
Station Name: Sweet Grass Law Repeater
Remote Access

FREQUENCIES

Transmit (MHz): 154.800
Call Sign: KNIA831
Receive (MHz): 158.730
FCC File No:
Transmit Power (watts): 100
Antenna Height (ft): 15

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax	Jumper
Length (ft)	Length (ft)
Type	Type
Diameter (inches)	Diameter (inches)

CIRCUIT DUPLEXER

Name:
Duplexer Model:
Notes: Filter system, cavity system.

Heating, Ventilation and Air Conditioning

Manufacturer:
Model Number:

BTU: **Amperes:** **Voltage:** **Phases:**

Description: A wall enclosured Dayton fan and baseboard heat currently at this site.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: None.

Waveguide Entrance

Total Ports: 2
Ports Used: 2
Notes: Holes drilled in cinder block wall.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
No				

Notes: None.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: None.

Converter

Equipment ID: **Manufacturer:** Motorola **Model Number:** Quantar
Amperes: **Fuse Positions:**
Output Voltage **Voltage:**
Notes: None.

Tower Information

Manufacturer	Type	Tower Height (ft)	FCC Registration Number	FAA Lighting	FAA Paint
Rohn	Guyed	100	Unknown	No	No

Horizontal Cable Line Bridge
None.

Ladder
☐ Climbing ☐ Cable

Tower Climbing Ladder
None.

Tower Grounding System
Tower grounding system is single wire to buried ground rod.

Electrical System

EMERGENCY GENERATOR

Manufacturer:
Model Number:
Fuel: **Fuel Capacity (gls):**
kW: **kVA:**
Voltage:
Phases:
Wires:
Notes on Generator:

TRANSFER SWITCH

Manufacturer:
Model Number:
Voltage: 0
Ampere: 0

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

Electrical System Notes:

EQUIPMENT ROOM GROUNDING SYSTEM

Single ground wire connected to exterior buried grounding rod.

CHARGER

Manufacturer:
Model Number:
Amperes: 0
Fuse Positions: 0
Input Voltage: 0
Output Voltage: 0
Notes: None.

BATTERY PLANT

Manufacturer: AC Delco
Model Number: M27MF
Ampere-Hour Rating: 550

Output Voltage: 0

Notes: None.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
No	Not informed of any.		

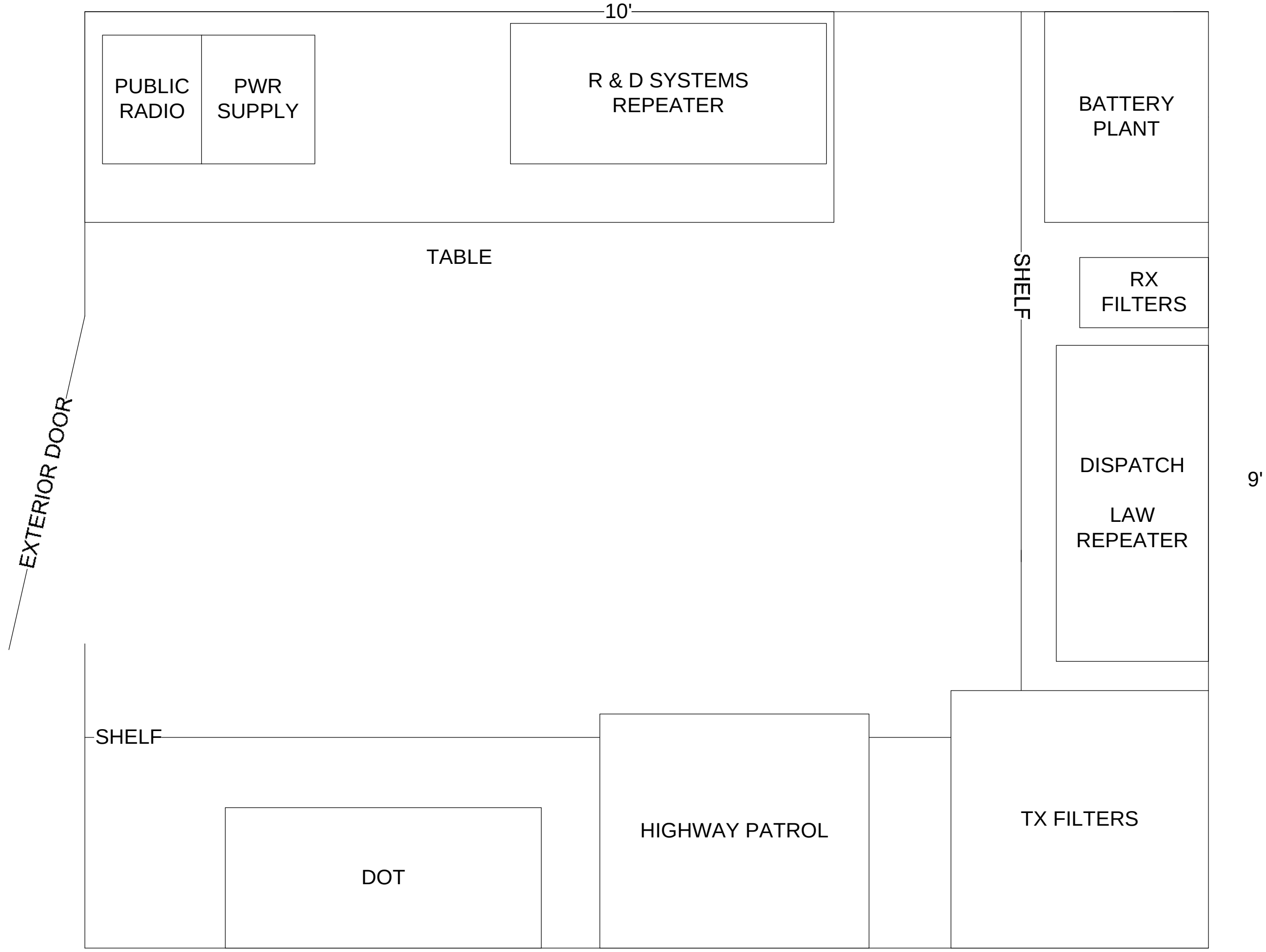
Description: None.

Bldg Entry: LMR enters the building through two holes in the cinderblock wall.

Notes: Steel door is in good condition. Key lock is required to open door.

Site Name: 0503

County Name: Sweet Grass



	NAME	DATE
DESIGN:	CTA	8/2/2005
DRAWN:	CMW	8/9/2005
CHECKED:	N/A	N/A
APPROVED:	N/A	N/A

REVISION DATE('S):

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20715 TIMBERLAKE ROAD
LYNCHBURG, VA 24502

PROJECT
SCMIC
INTEROPERABLE COMMUNICATIONS PLAN

TITLE
RADIO EQUIPMENT LAYOUT
TIN CAN HILL

COMM NO.	DWG. NO.	SCALE	PAGE
20077	0303	N/A	1 OF 1

0504	**Site Name**		**Site Type**
	Monument Repeater	**Site Contact**	**LMR**

Monument Peak, Big Timber, Montana, 59052

Kerry O'Connell
P.O. Box 567
Big Timber, Montana 59011
(406) 222-4108

Survey Date	**Surveyors**
07/11/2005	CMW

Observed Position (NAD83)

Latitude(N)	Longitude(W)
45.20555	110.22559

Site Access Requirements

Site access is eight miles through the Gallatin County forest to a clearing near the peak, then six tenths of a mile uphill through slide rock and grass. The shelter and antennas are located at the top.

Electric Utility None

Telephone Carrier None

Site Description

Mountain top solar site with shelter and antennas surrounded by rock and grass. The shelter is sitting below the plain of the top where the back is located on a steep decline. The antennas are buried in the rock above the shelter. Solor panels are located on the roof of the shelter.

Tower Description

There is no tower at this site.

Facility Grounding System

No outside grounding system surveyed at this site.

Building Assessment

N/A

Communication Shelter Manufacturer/Model

Communication Shelter Notes:

The shelter is an aluminum siding building. The roof is sloped at a fourty-five degree angle and is made of wood, cover with aluminum. The solar panels are on the roof. The door is 32" X 84" steel. The shelter foundation is concrete.

Land Mobile Radio Equipment

Manufacturer:
Model:
Power:
Alarms:
Redundancy Configuration

Notes: Did not access interior of site.
Station Name: Sweet Grass Monument Repeater
Remote Access None.

FREQUENCIES

Transmit (MHz):	154.980	**Call Sign:**	WPTQ340
Receive (MHz):	158.895	**FCC File No:**	
Transmit Power (watts):	33	**Antenna Height (ft):**	25

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax		**Jumper**	
Length (ft)	25'	**Length (ft)**	
Type	Heliax	**Type**	
Diameter (inches)	7/8"	**Diameter (inches)**	

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Land Mobile Radio Equipment

Manufacturer:
Model:
Power:
Alarms:
Redundancy Configuration
Notes: Did not survey the interior of the shelter.
Station Name: GNF Monument Peak
Remote Access

FREQUENCIES

Transmit (MHz):	164.125	**Call Sign:**	Unknown
Receive (MHz):	171.550	**FCC File No:**	
Transmit Power (watts):	Unknown	**Antenna Height (ft):**	25

ASSOCIATED EQUIPMENT AND CONNECTIONS

Coax		**Jumper**	
Length (ft)	30	**Length (ft)**	
Type	Heliax	**Type**	
Diameter (inches)	7/8"	**Diameter (inches)**	

CIRCUIT DUPLEXER

Name:

Duplexer Model:

Notes: None.

Heating, Ventilation and Air Conditioning

Manufacturer: **Model Number:**

BTU: **Amperes:** **Voltage:** **Phases:**

Description: Did not survey interior of shelter.

Uninterruptable Power Supply (UPS)

UPS ID Number:	Manufacturer	Model Number	Input Voltage	VA
			0	0

UPS Description: Did not survey interior of shelter.

Waveguide Entrance

Total Ports: 0

Ports Used: 0

Notes: Did not survey the interior of the shelter. Transmission lines from antenna's went underneath shelter.

Pressurization Equipment - Dehydrator

Dehydrator	Manufacturer	Model Number	Port Capacity	Ports Used
Unknown				

Notes: Communications shelter interior was not surveyed.

Alarm Unit

Equipment Number: **Manufacturer:** **Model:**

Notes: Communications shelter interior was not surveyed.

Converter

Equipment ID: **Manufacturer:** **Model Number:**

Amperes: **Fuse Positions:**

Output Voltage **Voltage:**

Notes: None.

Tower Information

Manufacturer	**Type**	**Tower Height (ft)**	**FCC Registration Number**	**FAA Lighting**	**FAA Paint**
	N/A		N/A	N/A	N/A

Horizontal Cable Line Bridge

None.

Ladder

☐ Climbing ☐ Cable

Tower Climbing Ladder

None.

Tower Grounding System

N/A

Electrical System

EMERGENCY GENERATOR

Manufacturer:

Model Number:

Fuel: **Fuel Capacity (gls):**

kW: **kVA:**

Voltage:

Phases:

Wires:

Notes on Generator:

TRANSFER SWITCH

Manufacturer:

Model Number:

Voltage: 0

Ampere: 0

Electrical System Notes:

DISCONNECT SWITCH

☐ **Disconnect Switch Available**

EQUIPMENT ROOM GROUNDING SYSTEM

Did not survey the interior of communications shelter.

CHARGER

Manufacturer:

Model Number:

Amperes: 0

Fuse Positions: 0

Input Voltage: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

BATTERY PLANT

Manufacturer:

Model Number:

Ampere-Hour Rating: 0

Output Voltage: 0

Notes: Communications shelter interior was not surveyed.

Roof Top Tower Information

Roof Top	Bldg Restrict	Roof Surface	Roof Surface Description
Yes	Not informed of any.		Wood covered with aluminum.

Description: Three solar panels facing South.

Bldg Entry: LMR enters from two parallel corners at the base of the shelter.

Notes: None.

Site Name: 0504
County Name: Sweet Grass